ELECTRICAL CONSTRUCTION AND MAINTENANCE

With ELECTRICAL CONTRACTING

AUGUST • 1948

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A McGRAW-HILL PUBLICATION

lamp-matched ballasts

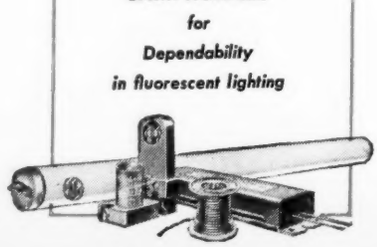
Here are reasons why ballast and lamp must be perfectly matched: If open-circuit *voltage* is too low, flickering seriously reduces lamp life. If starting *current* is low, cathodes are heavily bombarded—if too high, cathodes are overheated. Both reduce lamp life. If operating *watts* are too low, light output will be cut; if too high, lamp will overheat. Even the *shape* of the current wave is a major factor in light output and lamp life.

As a builder of both lamps and ballasts, G.E. is well aware of their inter-dependence. You'll find every G-E ballast matched to lamp requirements—truly kind to lamps—good for fixture satisfaction.

Kind to lamps

With General Electric ballasts you can be certain that your customers will obtain full light output and long life from their fluorescent lamps. Kind to lamps, quiet, long-lived, they are worthy companions for your finest fixtures. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

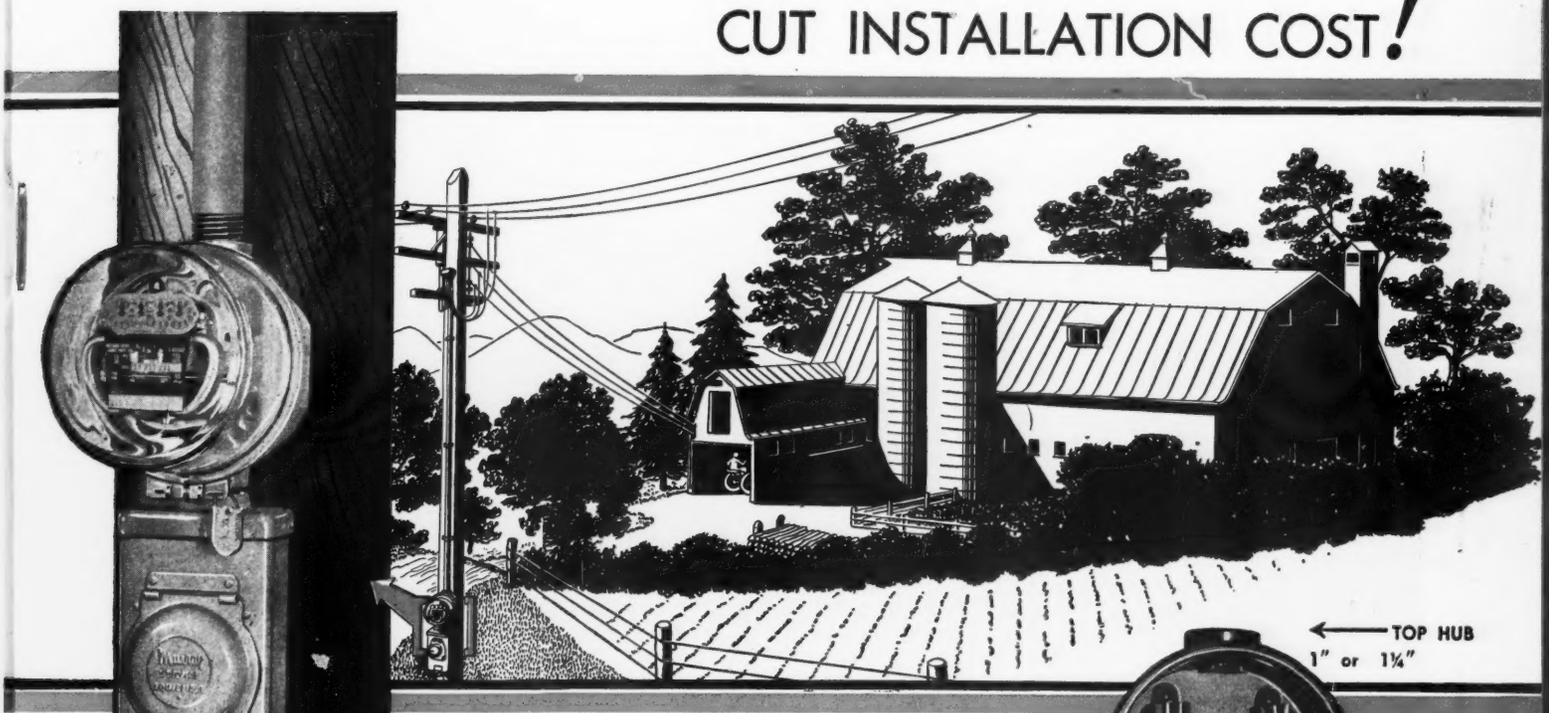
BALLASTS
CABLE
LAMPS
STARTERS
LAMPHOLDERS
for
Dependability
in fluorescent lighting

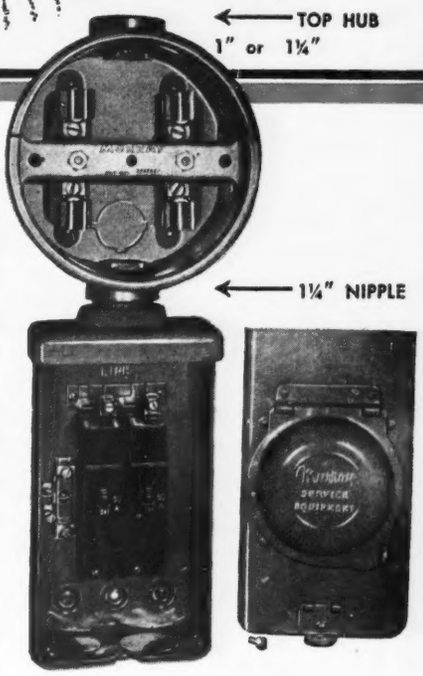


GENERAL ELECTRIC

412-61

NEW— Murray COMBINATION to CUT INSTALLATION COST!





Cat. Nos. 1962-35 or 1962-50

This new Murray Combined meter socket and yard pole breaker box answers the many requests for just such a labor and cost saving device.

The combination is staked at the factory, thereby eliminating the usual need for assembly and alignment. Installation on poles or walls is quick and simple.

A glance at the "High Spots" listed at the bottom, shows a few of the good reasons why it will be to your advantage to install the NEW Murray Combination Socket and Murray Magnetic Circuit Breaker Service Equipment.

SEND FOR BULLETIN No. 504

HIGH SPOTS

METER SOCKET

Deep-drawn aluminum case with integral weatherproof lip.
Turnproof watertight aluminum hub.
Reversible jaws, quickly adjustable for vertical or horizontal meter mounting.
Extra high dielectric strength. Independent laboratory tests demonstrated no 60-cycle flashover at less than 10,500 volts.

FACTORY STAKED NIPPLE

Joins meter socket and box into single rigid unit.

YARD POLE BREAKER BOX

Raintight deep-drawn seamless box.
A life-time weatherproof paint finish of Melamine Plastic base enamel.

MURRAY MAGNETIC CIRCUIT BREAKERS

No derating—will carry full rated load continually in direct sunlight and other exceptional conditions.
Instantaneous tripping under short circuit conditions.
Delayed tripping on light and medium overloads.

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PRODUCTION or CONSTRUCTION
Planned Lighting is Profitable!

INDUSTRIALITE HIGH MOUNTING FIXTURE

For use in railroad yards and roundhouses, steel mills, foundries—hundreds of heavy industrial installations.

APPLETON ELECTRIC PRODUCTS — MEG U.S. PAT. OFF.

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To plan lighting with Appleton Lighting Equipment is to more than meet the illuminating requirements of profitable production and lasting electrical construction.

Appleton Lighting Fixtures are manufactured in a variety of types and sizes to fit virtually every industrial job—indoors and out. They are quickly, easily installed, require a minimum of servicing and deliver maximum lighting efficiency at low operating cost.

The Industrialite High Mounting fixture shown above is typical of Appleton specialized design. Ruggedly constructed to deliver top performance under the most severe conditions, this fixture carries a flange on its cast aluminum hood that eliminates the possibility of the reflector jarring loose and falling to the ground.

Custom-made for profitable planned lighting, every one of the products in the Appleton Line of lighting equipment represents the combined result of top quality materials and expert engineering: STANDARD FOR BETTER WIRING.

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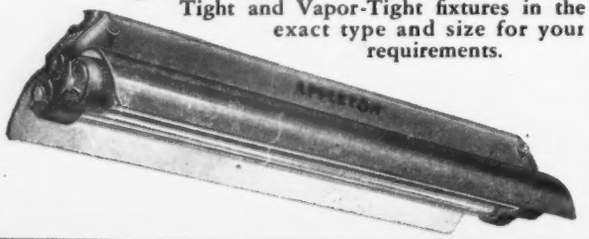
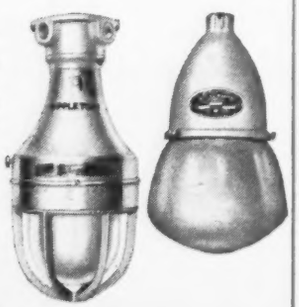
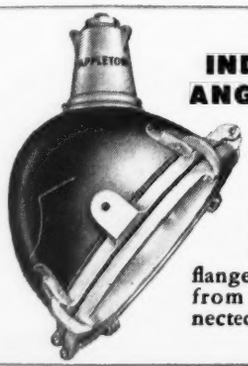
Appleton offers numerous types and combinations of dependable explosion-proof fixtures. Also, Dust-Tight and Vapor-Tight fixtures in the exact type and size for your requirements.







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Designed to meet the most severe industrial requirements. Supplied with cast aluminum hood which carries flange to prevent reflector from becoming disconnected.

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With which is consolidated Electrical Contracting. The Electragist and Electrical Record...Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

August • 1948

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You're wise, too, when you insist on Certified Ballasts.

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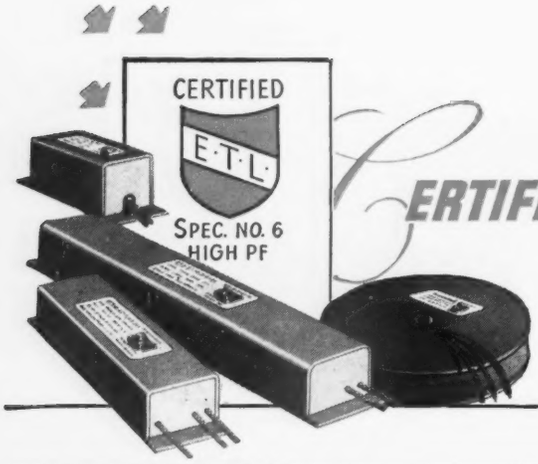
Certified Ballasts are better because they are built to rigid specifications that assure high performance—then are tested, checked and "certified" by impartial Electrical Testing Laboratories, Inc.



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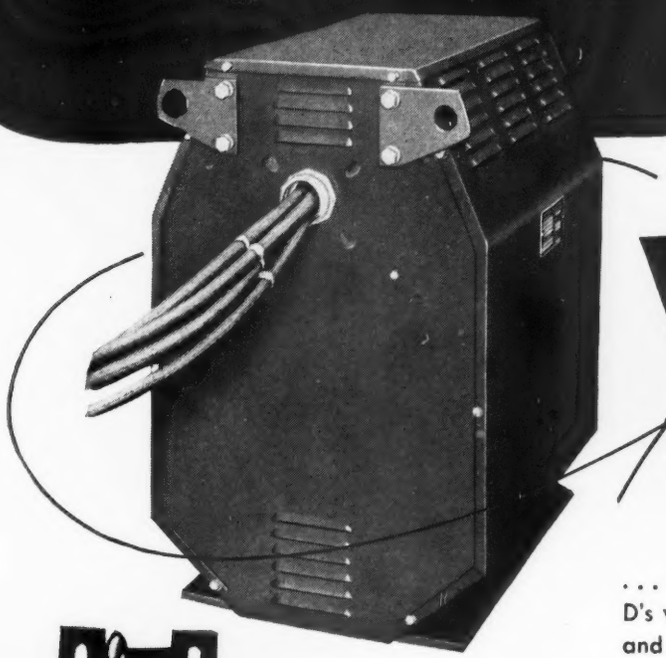
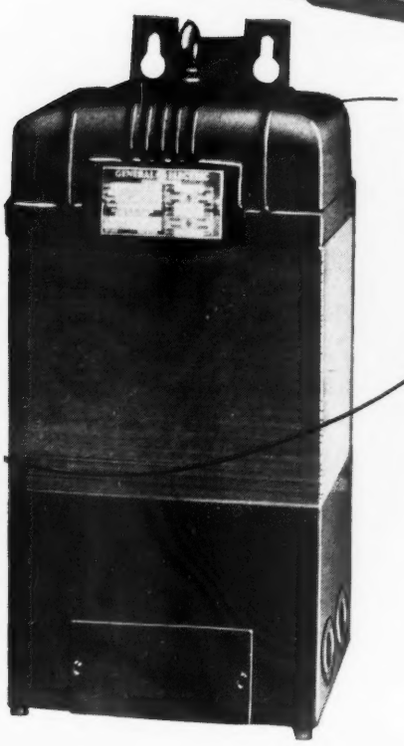
for dry-type transformers that are really dependable

General Electric **M & D** dry-type transformers, for power and lighting circuits 600 volts and below, are easy to install, quiet in operation, and completely dependable.

Small and compact in size, requiring no fireproof vault, these sturdy transformers are available for quick delivery—standard **M & D's** from stock; with special orders filled promptly. See your nearest **G-E** apparatus distributor, or write ***Apparatus Department, General Electric Co., Schenectady 5, New York.***



. . . where ratings of 15 kva and up are required. Type D's will give long-lived indoor service for phase changing and all general power and lighting applications.



. . . for requirements calling for 0.25 to 10 kva ratings. Versatile Type M units perform equally well indoors or out—for lighting, phase changing or general power needs —or for 32-volt lighting circuits in standard ratings.

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FOR CABLE YOU CAN USE ANYWHERE

Specify

VERSATOL-GEOPRENE

A RUBBER-TYPE CABLE FOR 600-VOLT POWER CIRCUITS THAT SAVES 3 WAYS

When you need a low-voltage cable and have an eye for economy, consider

VERSATILITY: You can use Versatol-Geoprene cables just about anywhere. They have RH approval for 75-deg C operation, RW approval for wet locations, USE approval for underground service-entrance use. There's no need for expensive conduit or armor; and no need for more than one cable type, whether the installation is outdoor, underground, or inside.

EASY HANDLING: Versatol-Geoprene is easy to handle, helps keep installation costs down. You'll find it as simple to splice and terminate as rubber. Its self-protecting jacket keeps weight low; high current-carrying capacity keeps bulk and handling costs down.

LONG LIFE: You'll find that another reason Versatol-Geoprene cables save you money is that they can stay in service longer. The Versatol* insulation has stood up under accelerated aging tests estimated to be the equivalent of 50 years normal life.

In addition the Geoprene** jacket virtually ignores all the old enemies of cable finishes. On a long-time basis it's physically and chemically way ahead of Tellurium, our famous prewar jacketing compound.

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*Reg. U.S. Patent Office; a G-E formulation of Buna-S (synthetic) rubber.

**Geoprene-special G-E compound containing approximately 60 per cent neoprene, with the balance consisting of plasticizers, accelerators, and reinforcing agents.

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For high-voltage feeders, distribution in underground ducts. Ideal for heavy loads in wet locations. Bulletin GEA-2623.

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For high-voltage power distribution. Has superior resistance to heat, corona, and aging. Bulletins GEA-1788, GEA-4848.

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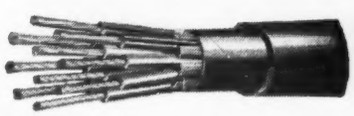
For power to portable shovels, pumps, construction machinery where resistance to rough handling and excessive flexing is needed. Bulletin GEA-4229.



FLAMENOL*
For low-voltage wiring. Its chemically inert insulation resists water, cutting oils, acids, and alkalies, and is flame resistant. Bulletin GEA-4352.

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- **WIDE RANGE OF TYPES, SIZES**
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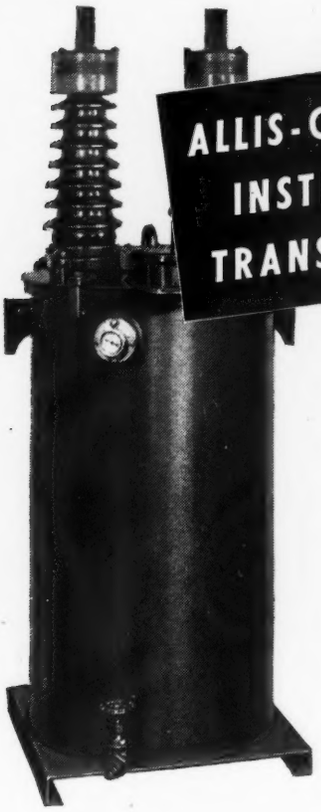

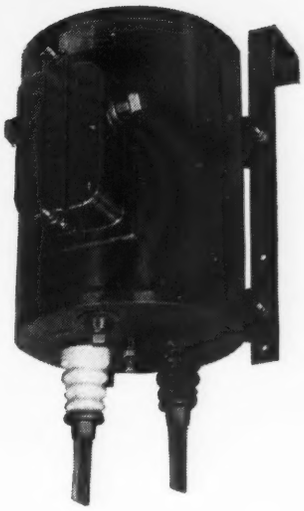

1. Easy to inspect — maintain — and the Type CW meets rigid requirements for accuracy for metering or relay applications. This oil filled outdoor current transformer furnished in ratings 15 to 69 kv; 10 to 800 amperes. Liberal design! Withstands overcurrent.

2. Accurate primary metering outdoors—wound type, compound filled current transformer in 5 to 15 kv classes. Pole top crossarm or substation steel mounting arrangements. Type CWD-1 (5 kv), CWD-2 (8.7 kv) and CWD-3 (15 kv) rated 10-800 amperes.

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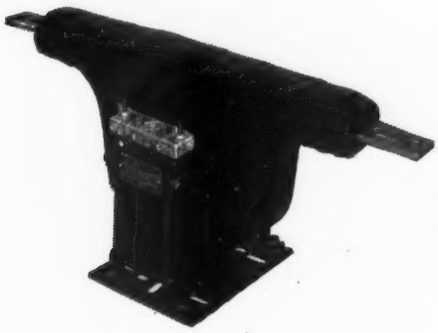

4. Get high accuracy over a wide range of burdens with this small heavy duty indoor current transformer. Built to ASA-NEMA standards and EEI dimensions. Furnished in Types MKE-5 kv, K2E-8.7 kv, K3E-15 kv, 10 to 800 amperes. Double secondary winding if desired. Call an A-C representative, or send coupon to ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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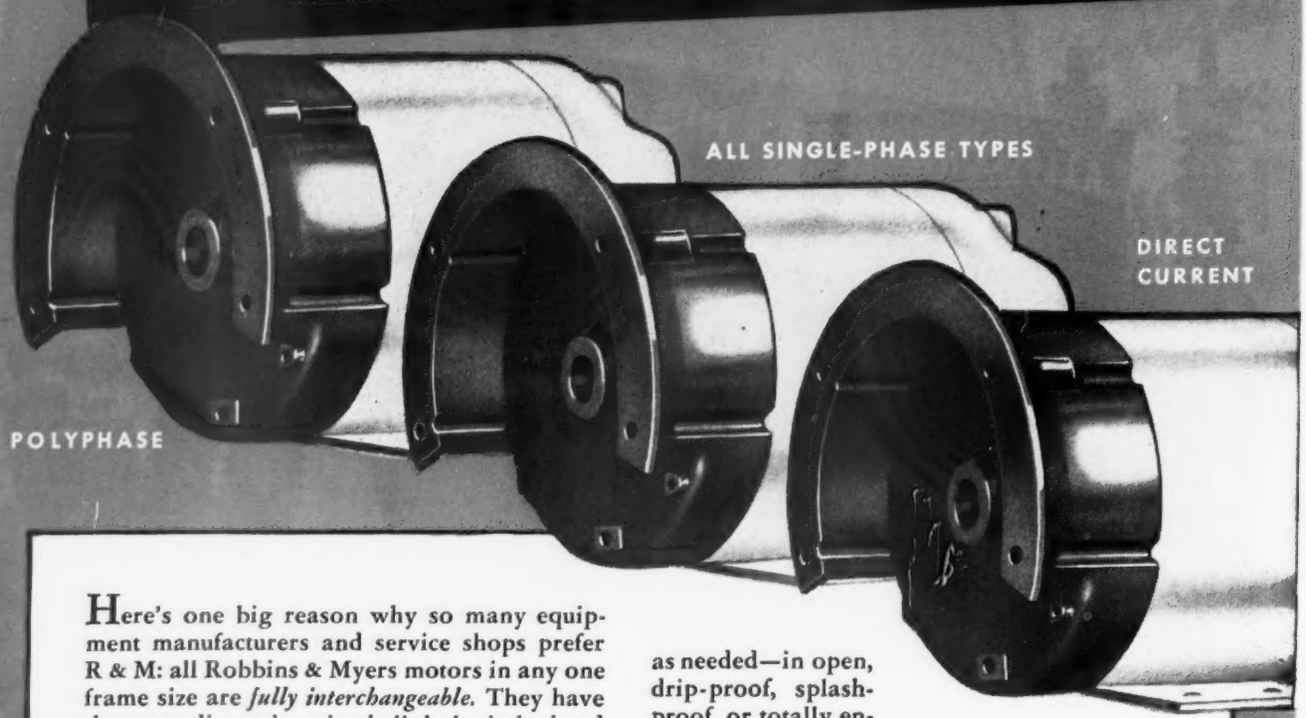

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INTEGRAL HORSEPOWER

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The NEW Guthlite* SWINGS DOWN on the MARVELOUS JACKNIFE HINGE!

This Magic Wand Does The Trick!

No wonder maintenance costs take a nose dive, when maintenance time is cut as much as 80% with GUTHLITE!

No more maintenance ladders! No more acrobatic porters! No more fuss, muss, bustle, or bother! Now, with the amazing new GUTHLITE, fluorescent maintenance is a fast, simple, floor-level job!

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Leaders in Lighting Since 1902

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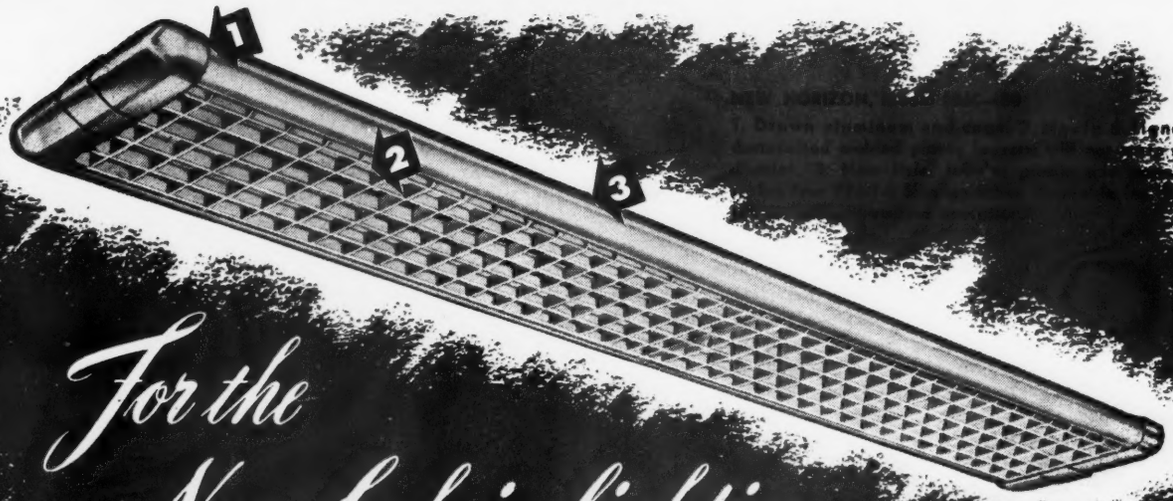
CUTLER-HAMMER
MULTI-BREAKER
C-H

It measures only 5x7 yet it provides thermal-magnetic trip, has 4 poles, is easy to install and wire

and . . . it's CUTLER-HAMMER engineered throughout . . .



For the New Look in lighting . . .

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LEADER ELECTRIC COMPANY

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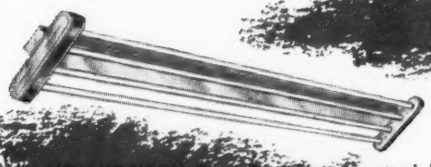
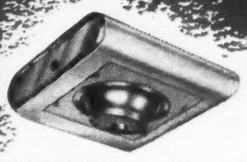


Leader NEW HORIZON Open Type Fixture especially designed for wide flashing of large classrooms. Available in one lamp (NHO-180), two lamp (NHO-[illegible]) or three lamp (NHO-380) [illegible] operation; 100, 200 or 300 milliampere operation.



The NEW HORIZON Incandescent Spotlight. Excellent for highlighting displays. Available for corner installations (Cat. No. LS-40) or between fixtures in continuous runs (Cat. No. LS-70).

NO. 1710

With 2¼" Fitter
Completely Wired and
Mounting Straps for 3¼" and
4" Outlet Box or Gem X Box

1710 Pull Chain
with Convenience Outlet
1711 Keyless
with Convenience Outlet
1712 Pull Chain, No Outlet
1713 Keyless, No Outlet

BASE 6" x 4⅝"

Pull Chain, 250 Watts, 250 Volts
Keyless, 660 Watts, 250 Volts
Convenience Outlet
15 Amps. . . . . 125 Volts
10 Amps. . . . . 250 Volts

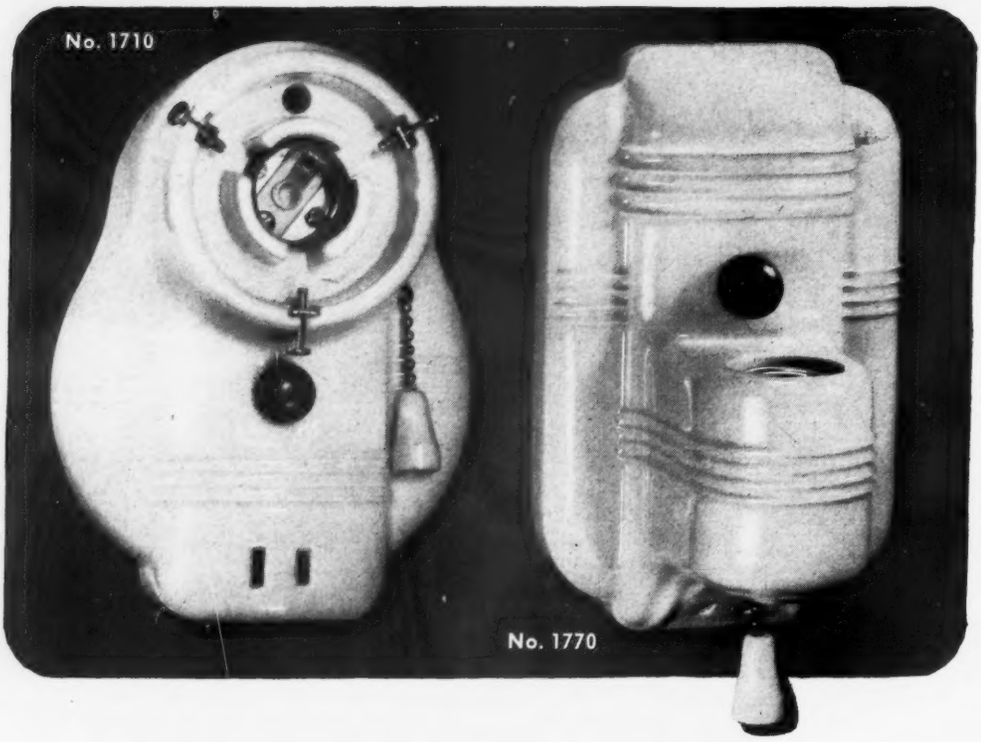
NO. 1770

Completely Wired, with
Mounting Straps, for 3¼"
Outlet Box or Gem X Box

1770 Pull Chain
with Convenience Outlet
1771 Keyless
with Convenience Outlet
1772 Pull Chain, No Outlet
1773 Keyless, No Outlet

BASE 6" x 3⅝"

Pull Chain, 250 Watts, 250 Volts
Keyless, 660 Watts, 250 Volts
Convenience Outlet
15 Amps. . . . . 125 Volts
10 Amps. . . . . 250 Volts



Paulding KAOLITE *fixtures*

For twenty years Paulding Kaolite Line has met, with satisfaction, the needs of our many customers. The quality and finish is everlasting.

It is recognized that porcelain is *THE BEST INSULATOR KNOWN* to the electrical industry, giving an unusual degree of protection. Our porcelain is composed of the best carefully selected materials which are passed through a very exacting cleansing process, thereby making a perfect porcelain body from our own formula for the purpose of moulding all units and bathroom fixtures which are designed on lines to eliminate any undercuts or fancy crevices which act as dust and dirt collectors.

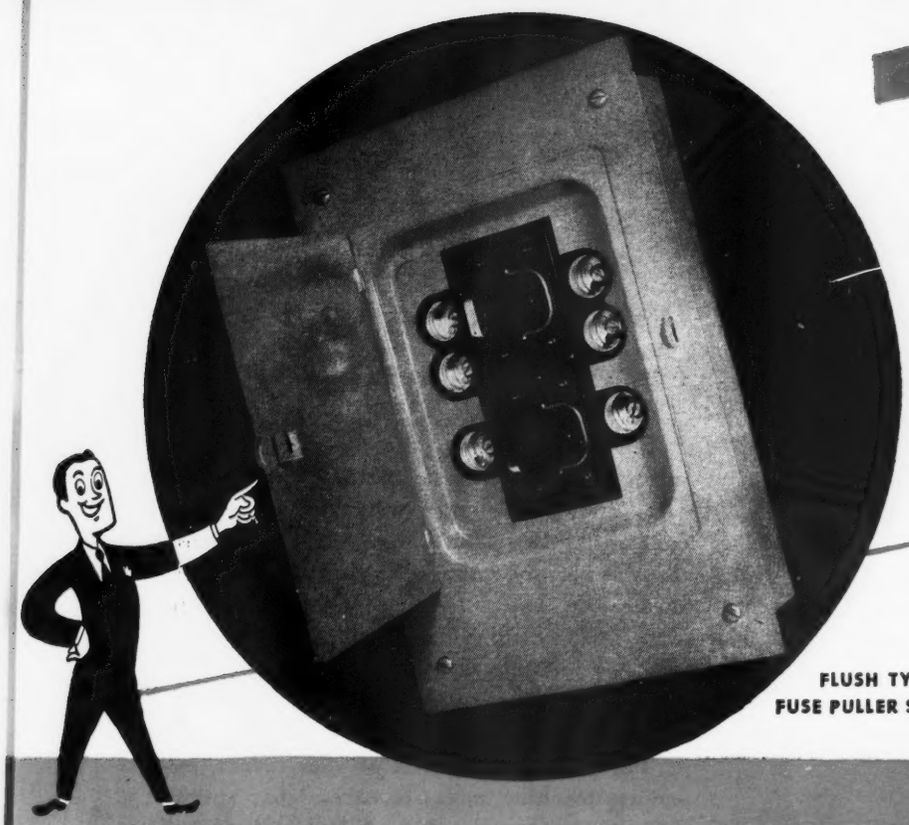
No metal polish is necessary to clean them — *JUST WIPE WITH A DAMP CLOTH TO RESTORE THEIR ORIGINAL LUSTER.* Our porcelain is fired at approximately 2300°, making a solid vitreous piece and ranks first among this type of product.

Over the years our engineers have made a special study of the effect which air and moisture has on the finish of all of our products. All glaze is carefully compounded so as to add a hard and glossy finish to our hard and vitreous body. Each item is designed so few metal parts will show from the front surface, therefore, *NO CORROSION, TARNISHING, OR RUSTING* will take place especially where these items are used in bathrooms, kitchens, or humid, salty atmospheres.

All mechanisms in the Kaolite Line of fixtures are *TESTED DAILY IN OUR OWN LABORATORIES* to insure first class performance. Each piece carries an Underwriters' Laboratory, Inc. label for the security of the public. Twenty years of service to satisfied customers is a record which speaks for itself.

KAOLITE

JOHN I. PAULDING, INC. NEW BEDFORD, MASS.



It's good electrical practice

to combine all residential electrical circuits in one panel, rather than use an assortment of individual units.

FLUSH TYPE
FUSE PULLER SWITCH

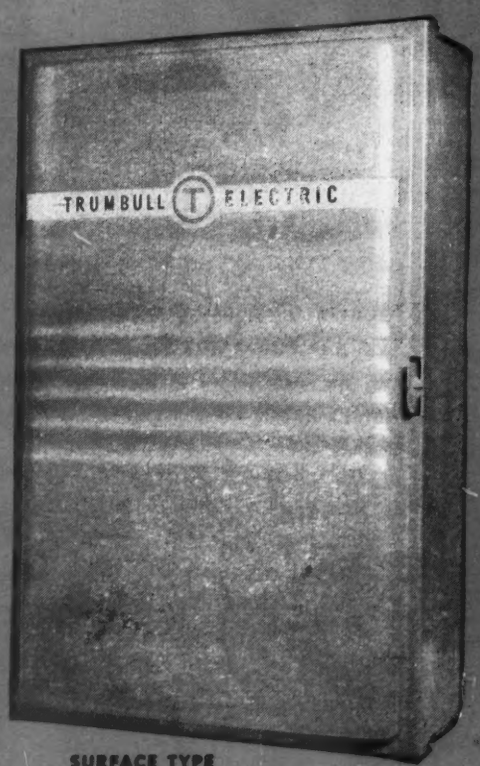
It's good Electrical Practice . . .

to install a Trumbull Fuse Puller Switch, the residential panel for main, range and lighting circuit protection, with terminals for water heater connection.

There's plenty of wiring room. With top, bottom and side gutters entirely open, and the switch interior removable (simply by loosening one screw), Trumbull Fuse Puller service equipment is easy to wire. Easy to buy, too—the combination of circuits in each device represents a considerable saving compared with the cost of the same circuits purchased separately.

Whatever the specifications call for—switches, control centers, distribution systems—it's always good electrical practice to specify Trumbull, the name that safeguards *your* safe practice. THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories and offices throughout the U. S. Foreign representation.

TRUMBULL (T) ELECTRIC



SURFACE TYPE
FUSE PULLER SWITCH

MEN WHO OBSERVE THE BEST PRACTICES MAKE IT A PRACTICE TO USE TRUMBULL

Standard
TRADE MARK

Dry type, air cooled TRANSFORMERS

Designed and built to your specification

STANDARD gives the electrical manufacturing industry a service that is hard to duplicate. Engineering and production facilities are coordinated to quickly design and manufacture transformers of voltage, capacity, frequency, dimensions and mounting facilities to meet even the most unusual requirements.

The same high accuracy and fundamentally sound construction are yours whether you require one or a thousand transformers.

For power and control of your cranes, elevators, machine tools, furnaces, etc., specify STANDARD transformers. A letter, phone call or wire will quickly produce a solution to your transformer problem.

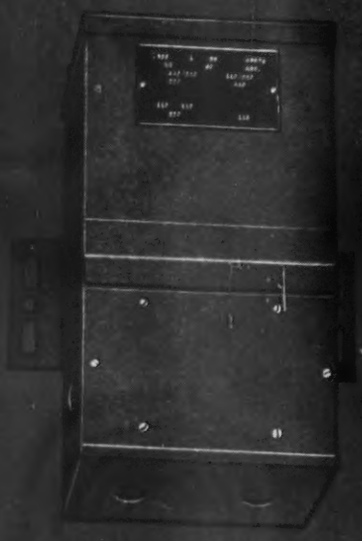
OVER 25 YEARS OF TRANSFORMER ENGINEERING

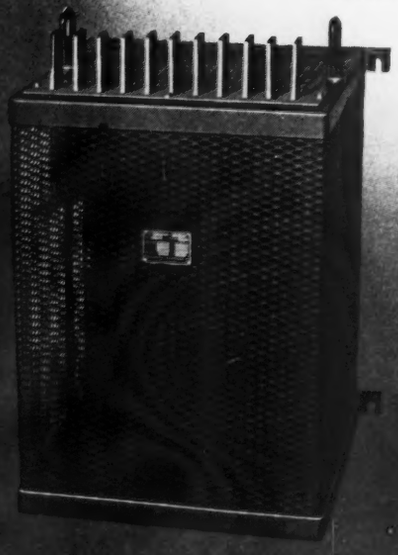
THE STANDARD TRANSFORMER CO.

WARREN • • • OHIO

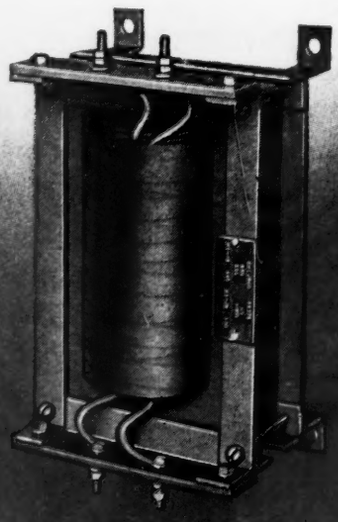
MAKERS OF POWER, DISTRIBUTION, INSTRUMENT, STREET LIGHTING AND TESTING TRANSFORMERS • • OIL, ASKAREL OR AIR COOLED

Offices in Principal Cities





Multi-tapped transformer for power supply to small electric furnaces. Glass insulated for Class B (80° C. rise) construction.

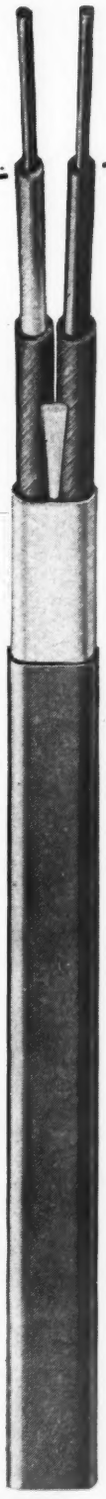


Shell type construction, bracket mounted transformer. Low capacity, low voltage for controls or power supply of machine tools. Made without case for mounting in or on equipment.

announcing SUPER PVX*

NONMETALLIC SHEATHED CABLE

has rotproof thermoplastic insulation and jacket



for those jobs that need cable with big, extra values!

For those jobs where extra quality is a "must" —for those difficult jobs where easy installation and long service are important—look into the big, new, extra values that go with Super PVX, General Electric's top-quality nonmetallic sheathed cable.

EXTRA TOUGH —No need to coddle Super PVX in installation or any time during service life. Thermoplastic-insulated conductors, a reinforcing glass braid, and a thermoplastic over-all jacket provide ideal protection from abrasion, moisture, flame, fumes, and corrosive vapors.

EXTRA EASY TO INSTALL —Super PVX proved, in repeated tests, that it can slash installation time. Its special construction results in a considerable reduction in over-all dimensions and a substantial reduction in weight. Smooth, new, mar-resistant thermoplastic finish slips easily through wood joists, can be stripped clean, easily, fast.

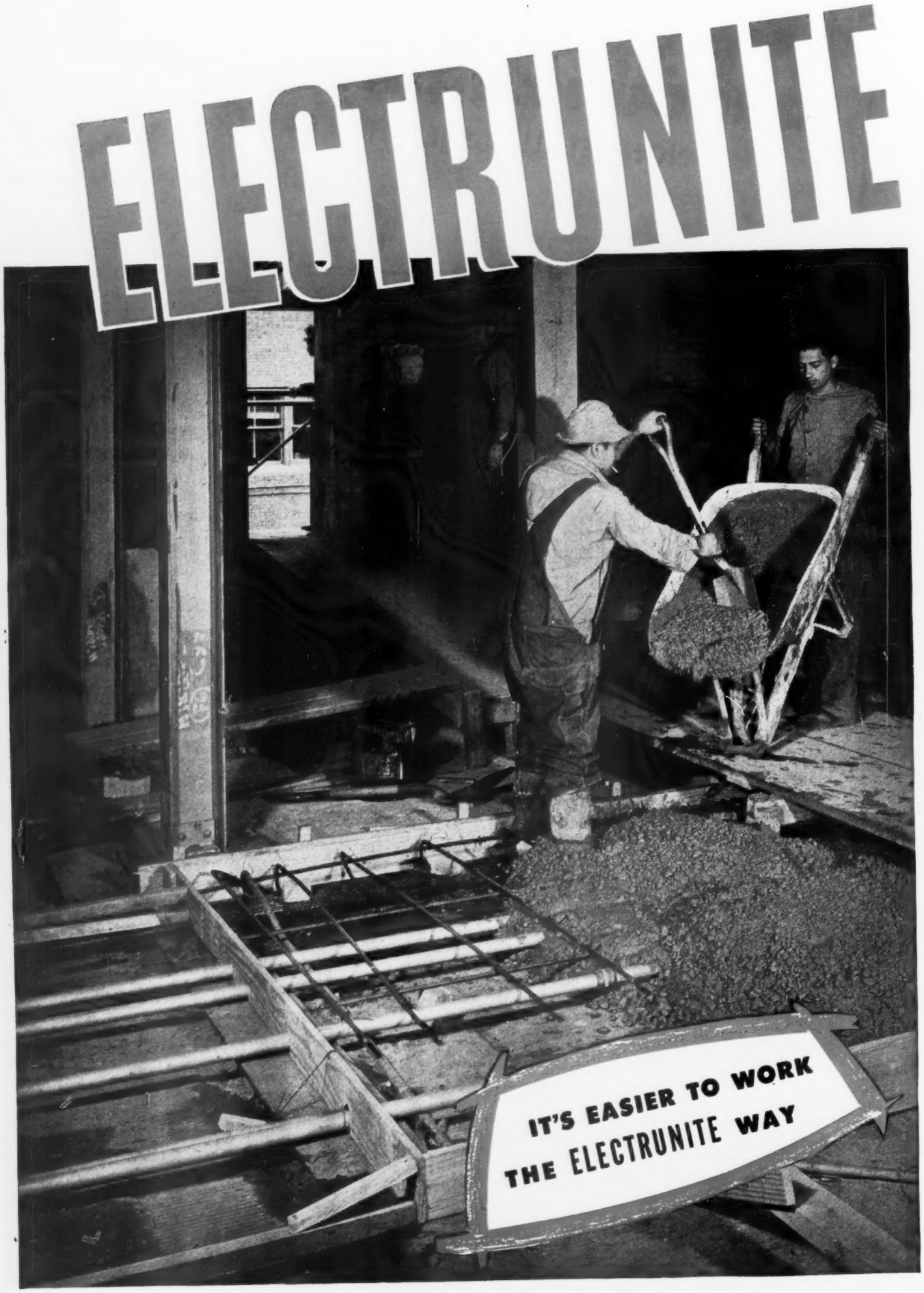
EXTRA SERVICEABLE under the worst conditions. Super PVX is approved by the Underwriters' Laboratories, Inc. — is excellent for use in livestock houses, dairy barns, roadside stands, and other places where conventional nonmetallic sheathed cables fail under exposure to fumes and corrosive vapors.

EXTRA GOOD-LOOKING —The smooth, clean finish on Super PVX is extra good-looking for exposed wiring jobs. It comes in ivory and brown colors which harmonize with available surface wiring devices.

Try Super PVX on the tough jobs—and try it on the top quality jobs. We know you'll be as excited about it as we are. For samples, see your General Electric Construction Materials distributor, or write to Section W3- 818, General Electric Company, Bridgeport 2, Connecticut.

*Trade-Mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC


ELECTRUNITE
IT'S EASIER TO WORK
THE ELECTRUNITE WAY

E.M.T. *eliminates* THREAD-CUTTING

● There's no question about wiring jobs going in easier when you use Republic ELECTRUNITE E. M. T.— the original lightweight rigid steel raceway. This modern conduit completely eliminates tedious, dirty thread-cutting . . . eliminates, too, the need for turning long lengths of tubing in cramped, hard-to-reach locations.

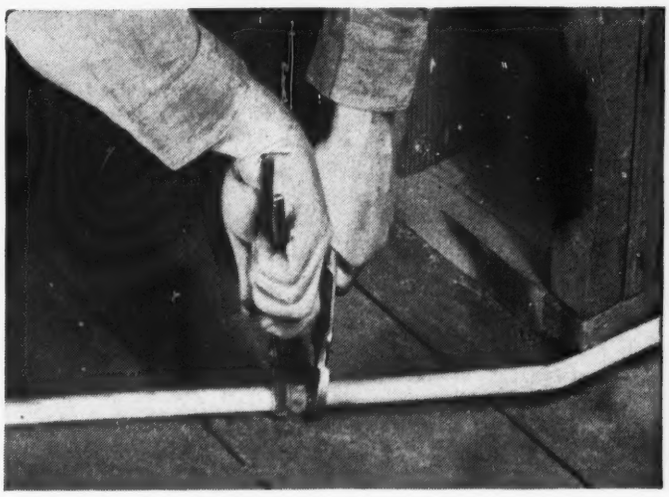
When connected with simple compression-locking fittings, every ELECTRUNITE E.M.T. raceway—no matter how long—is safe, strong and water-tight . . . approved by the National Electrical Code for use in exposed, concealed and concrete slab installations.

This is but one of the many trouble-saving advantages afforded by Republic ELECTRUNITE E.M.T.— one *more* of the job-proved reasons why contractors everywhere agree that *it's easier to work the ELECTRUNITE way.*

Like more information? See your nearest ELECTRUNITE Distributor or write direct to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Bldg., New York 17, New York

No need for thread-cutting equipment with modern ELECTRUNITE E.M.T. A compression coupling—slipped over the ends of the lengths to be joined—makes strong, concrete-tight joints in a hurry.



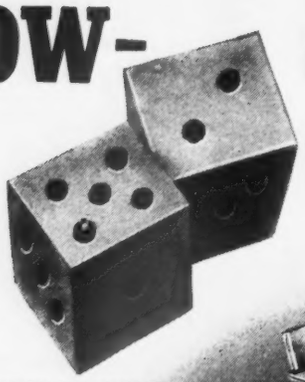
Coupling is easily tightened with wrenches or pliers. Because each fitting acts as a union it never is necessary to turn the tubing.

REPUBLIC STEEL

Republic
ELECTRUNITE E.M.T.
REG. U. S. PAT. OFF.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

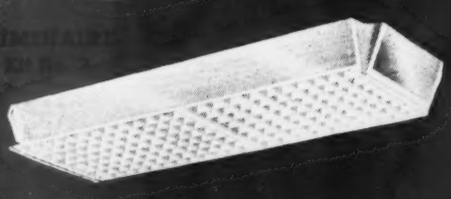
NOW- a Profitable Seven that wasn't just Luck!



• "URC" LUMINAIRE
Basic Unit 1040 + Kit No. 1 = Model 1041

• V-SHAPED LUMINAIRE
Basic Unit 1040 + Kit No. 2 = Model 1042

• LOUVERED LUMINAIRE
Basic Unit 1040 + Kit No. 3 = Model 1043

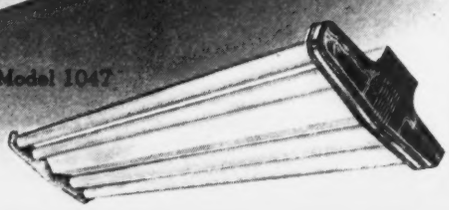


• SKYLINER
Basic Unit 1040 + Kit No. 4 = Model 1044

• SKY LOUVER
Basic Unit 1040 + Kit No. 5 = Model 1045

• SKY RAY
Basic Unit 1040 + Kit No. 6 = Model 1046

• ROYAL
Basic Unit 1040 + Kit No. 7 = Model 1047



ELECTRO'S BASIC UNIT SERIES IS A PLANNED AND PROVEN PROFIT BUILDER IN . . .

- **Sales**
- **Installation**
- **Maintenance**

CUT INVENTORY COSTS from 40 to 60% yet maintain a completely flexible stock of fluorescent fixtures with *Electro's Basic Unit Series.* Planned for higher profits and greater economy, all Electro fixtures are designed for one-man installation with the aid of the patented "Speedy Hanger" feature...also for *low cost* maintenance. Fluorescent luminaires pictured are all "four light". . . also available in Electro Basic Unit "two light" series.

BE "BASIC" IN '48

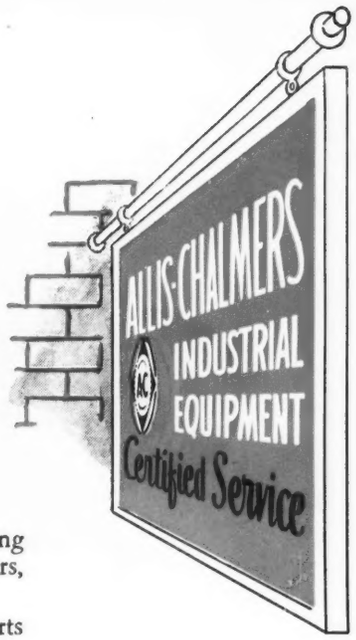
ELECTRO'S LIGHTING ENGINEERS ARE ALWAYS AT YOUR SERVICE

ELECTRO MANUFACTURING CORPORATION

2000 W. Fulton St. • Chicago 12

"Certified" Service

AN ADDED REASON FOR INVESTING IN ALLIS-CHALMERS MOTORS!



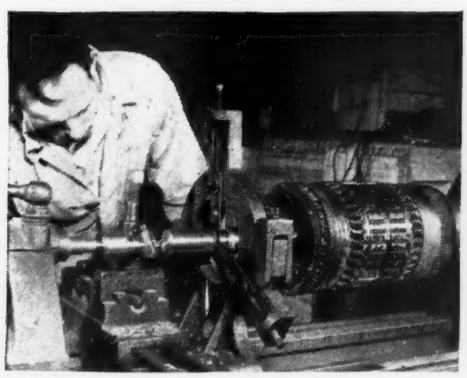
IT MEANS: 1) *Better, Faster Service.* Independent local repair shops are now being selected and authorized to service and repair Allis-Chalmers Motors, Transformers, Controls, Pumps — and "Certify" them as to workmanship.

2) *Finest Parts and Workmanship.* Shops use genuine Allis-Chalmers repair parts — or parts of equal quality; and are given complete service information, including factory procedure and drawings where necessary.

3) *Friendly Service.* Every Allis-Chalmers "Certified" Service Shop has been selected on the basis of its reputation in its community. It's the kind of company you *like* to do business with!

How can you get this service? For the present most "Certified" Service Shops are located in the larger U. S. industrial areas . . . but they're expanding rapidly. Call your nearby A-C District Office or Authorized Dealer for closest recommended shop. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

FINER, FASTER, FRIENDLIER SERVICE FOR INDUSTRY!



The A-C Supply Company of Cuyahoga Falls, Authorized Allis-Chalmers Dealer and newly-appointed "Certified" Service Shop, is staffed and equipped to give prompt, efficient, top-quality repair and service aid to customers in the greater Akron industrial area. Typical of the kind of "Certified" Service organizations being selected throughout U.S.

MANY SIZES, RATINGS OF ALLIS-CHALMERS STANDARD SQUIRREL-CAGE MOTORS ARE NOW AVAILABLE FROM STOCK. CHECK YOUR AUTHORIZED A-C DEALER, OR DISTRICT OFFICE FOR DETAILS.

A 2506

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

STOPS BLUE MONDAY!

PFFFFFT!! There she blows! All sorts of things to be done, besides the washing. And when the washing machine starts, out goes the fuse!

Madam isn't pleased. In fact, she is hopping mad. Perhaps, despite her distrust of man and his contrivances, she'll replace the fuse herself. Quite as likely, she'll call the electric company. Anyway, a lot of trouble for nothing — and on Monday, blue Monday!

Trouble for nothing? For nothing is right. If there had been a TRIONET on the washing machine circuit, instead of an ordinary fuse, the machine would have started. TRIONET is a dual-element thermal circuit protector, like its big brother for industrial use, the TRION. It allows motors to start on a safe overload; yet it protects against all hazardous overloads. This is because it is used at the same rating as the motor, not a higher one. It gives full working value and full protection to any electrical circuit or appliance.

Ends needless fuse blowing; stops blue Monday! Try TRIONET!

TRIONET : 3-IN-1

THE MOTOR FUSE

THE CHASE-SHAWMUT COMPANY, NEWBURYPORT, MASSACHUSETTS

Boston, New York, Syracuse, Philadelphia, Pittsburgh, Baltimore, Atlanta, New Orleans, Dallas, Detroit, Columbus, Indianapolis, Chicago, Omaha, Kansas City, St. Louis, Minneapolis, Denver, Los Angeles, San Francisco, Seattle

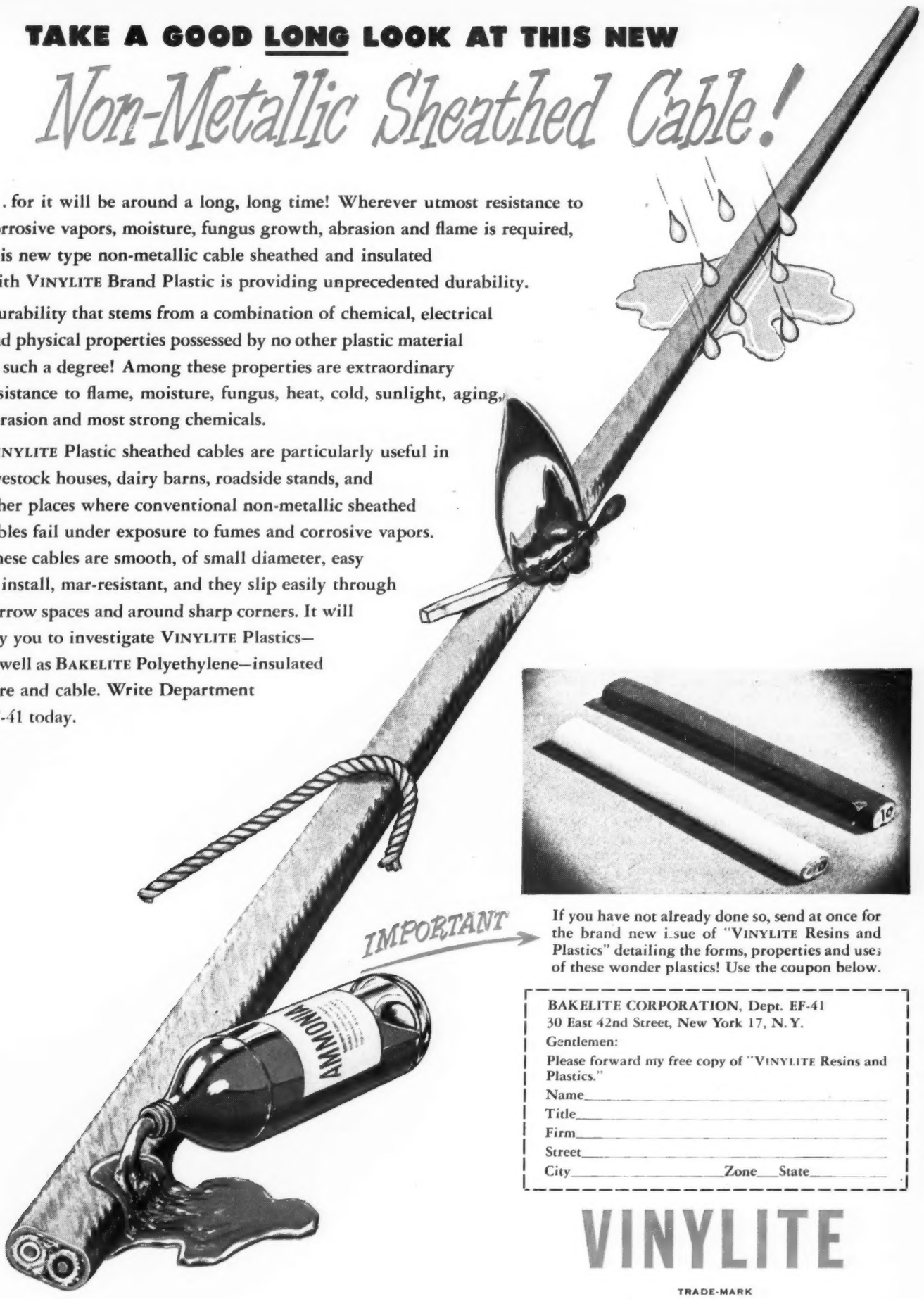
TAKE A GOOD LONG LOOK AT THIS NEW

Non-Metallic Sheathed Cable!

. . . for it will be around a long, long time! Wherever utmost resistance to corrosive vapors, moisture, fungus growth, abrasion and flame is required, this new type non-metallic cable sheathed and insulated with VINYLITE Brand Plastic is providing unprecedented durability.

Durability that stems from a combination of chemical, electrical and physical properties possessed by no other plastic material to such a degree! Among these properties are extraordinary resistance to flame, moisture, fungus, heat, cold, sunlight, aging, abrasion and most strong chemicals.

VINYLITE Plastic sheathed cables are particularly useful in livestock houses, dairy barns, roadside stands, and other places where conventional non-metallic sheathed cables fail under exposure to fumes and corrosive vapors. These cables are smooth, of small diameter, easy to install, mar-resistant, and they slip easily through narrow spaces and around sharp corners. It will pay you to investigate VINYLITE Plastics—as well as BAKELITE Polyethylene—insulated wire and cable. Write Department EF-41 today.



IMPORTANT → If you have not already done so, send at once for the brand new issue of "VINYLITE Resins and Plastics" detailing the forms, properties and uses of these wonder plastics! Use the coupon below.

BAKELITE CORPORATION, Dept. EF-41
30 East 42nd Street, New York 17, N. Y.
Gentlemen:
Please forward my free copy of "VINYLITE Resins and Plastics."
Name_____
Title_____
Firm_____
Street_____
City_____ Zone___ State_____

VINYLITE

TRADE-MARK

PLASTICS

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

EXPLOSION-PROOF PYLETS

... for Hazardous Locations

EXPLOSION-PROOF SWITCH PYLETS

1. *TUMBLER SWITCHES with push-pull Rod* to control motors or lighting circuits in hazardous locations. 1 and 2 gang, 1, 2 and 3-pole, 10 to 30 ampere, also 3 way and 4 way, 10 and 20 ampere types.

2. *TUMBLER SWITCHES with interlocking Plug* Receptacle for use as service outlets for portable electrical equipment in hazardous locations. Plugs cannot be inserted or withdrawn unless switch is open. Switch cannot be closed unless plug is fully inserted. 2 and 3-pole, 20 and 30 ampere, 250 and 460 volt ratings.

3. EXPLOSION-PROOF SECONDARY CIRCUIT BREAKER PYLETS for protection of motors against overloads and stalled rotor currents. Can also be used for "on" and "off" switch. Single and double pole with a selection of interchangeable heater units for protecting fractional horsepower motors.

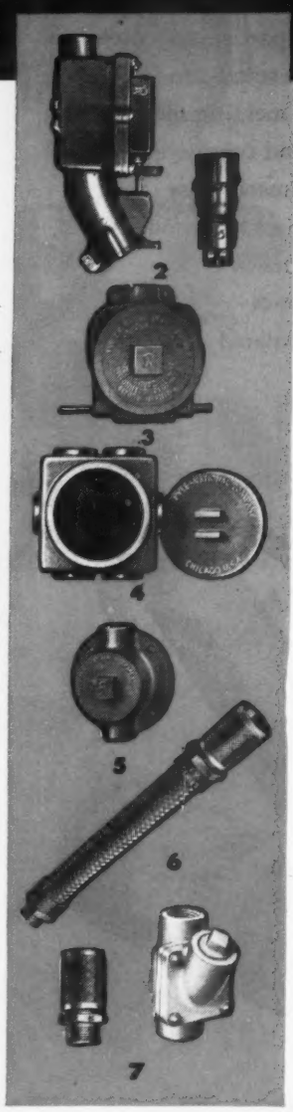
4. EXPLOSION-PROOF UNIVERSAL JUNCTION PYLETS—6, 7 and 10 hub types with close-up plugs. For easy replacement of sheet metal knockout boxes in the rewiring of old gasoline pump installations.

5. EXPLOSION-PROOF JUNCTION PYLETS available in a wide selection of styles and sizes with threaded or union type hub. Furnished with plain covers for general use or with covers tapped for conduit to support lighting fixtures. Also furnished with pipe plug angle type cover for filling with sealing cement.

6. PYLE-O-FLEX flexible explosion-proof and watertight fittings for adjustable and vibrative connections to motors, floodlights and pendant type lighting fixtures. Furnished in any combination of male and female threaded or female union type end connections with flexible lengths of 4 to 36 inches, conduit sizes ½" to 2" inclusive.

7. EXPLOSION-PROOF SEALING PYLETS have removable pipe plug covers which can be mounted in any one of four positions for filling with cement. Used to isolate the wiring compartments of arc-producing devices from balance of conduit system.

EXPLOSION-PROOF UNIONS, male and female, straight and 90° elbow types.



A line of the most commonly used types of conduit fittings for hazardous locations as defined in Article 500 of The National Electrical Code. Explosion-proof Pylets are designed in accordance with Underwriters' Laboratories requirements and are classified in their list of inspected electrical appliances. Their substantial construction and the high quality of materials and workmanship insure safety, uninterrupted service and long life. Consult your Pylet Catalog 1100 for complete listings of the above and other Explosion-Proof and Dust-Tight Pylets.

THE PYLE-NATIONAL COMPANY

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

Offices: New York • Baltimore • Pittsburgh • St. Louis • San Francisco • St. Paul • Cleveland
Export Department: International Railway Supply Co., 30 Church St., New York
Canadian Agent: The Holden Co., Ltd., Montreal

SINCE 1897

PLUGS and RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • LOCOMOTIVE HEADLIGHTS • MULTI-VENT AIR DISTRIBUTION

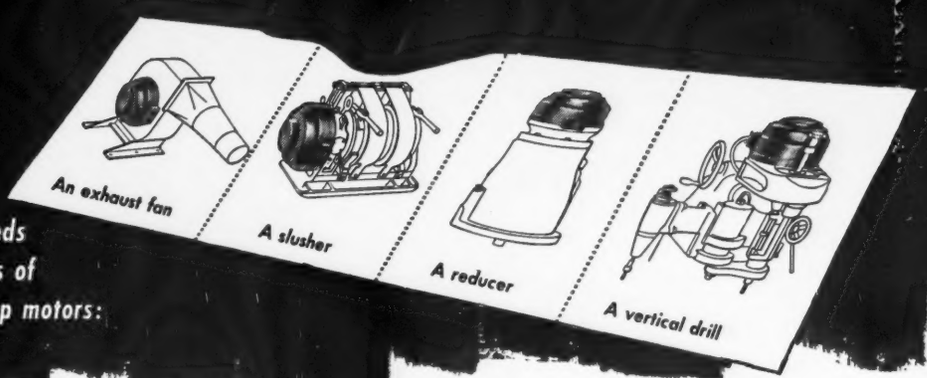
50%

Shorter!

30%

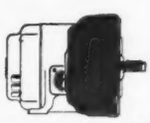
Lighter!

. . . than other motors of the same horsepower!



a few of hundreds of applications of axial air-gap motors:

THE FAIRBANKS-MORSE *axial air-gap Motor!**



NEWEST THING IN ELECTRIC MOTORS! For many applications the desirability of smaller, lighter, more compact motors has been well recognized—but not until the development of the axial air-gap motor by Fairbanks-Morse engineers has the need been filled. Here, then, are motors that will blend with the contour of the driven member . . . motors that are lighter, smaller, and more compact . . . sturdy, two-bearing motors that will give more than the required performance.

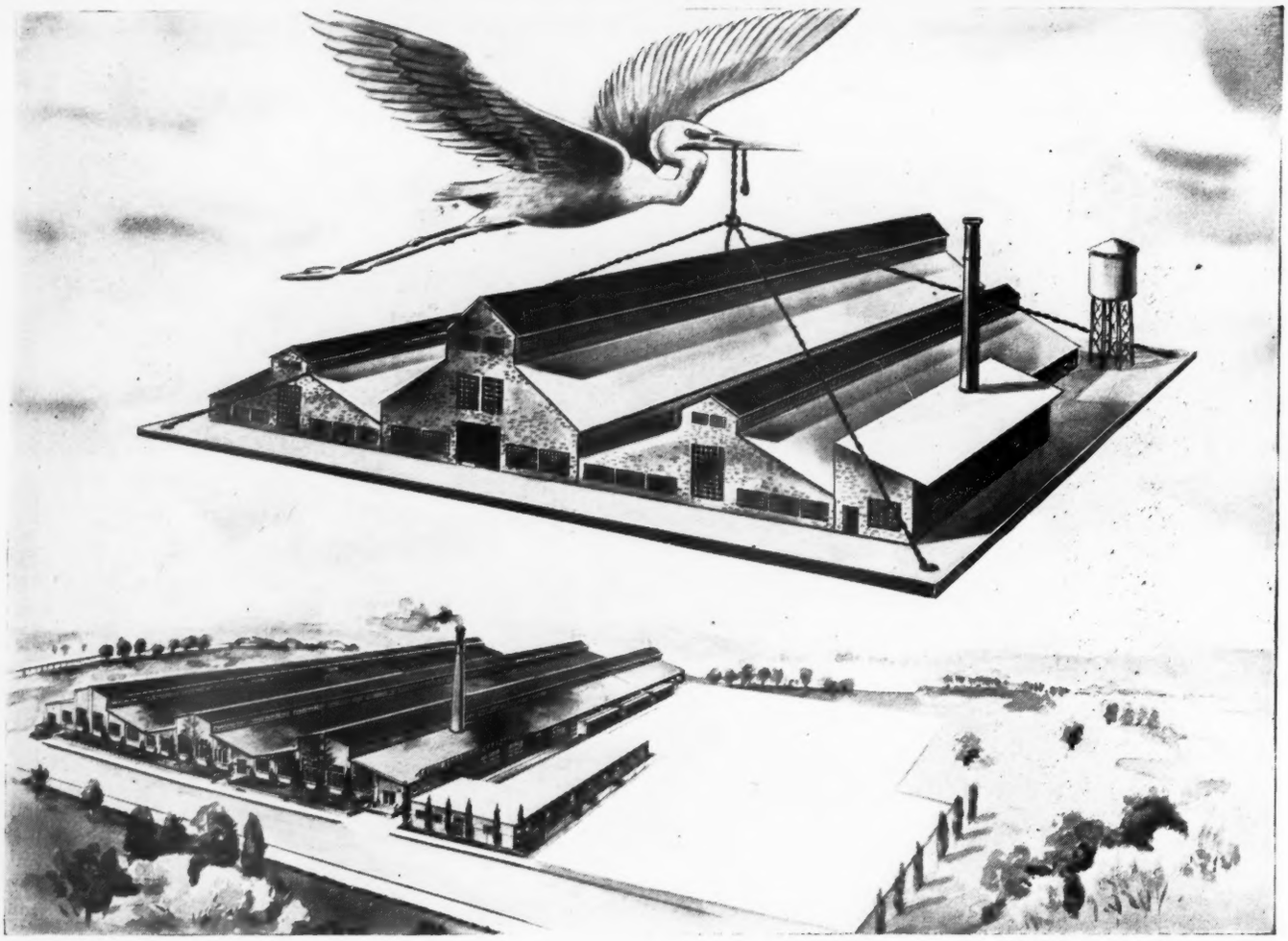
Perhaps you have already heard of the axial air-gap motors. That would be because they have already been proved on thousands of installations during a long period of test. If you would like to learn more about them—or any of the widely known line of conventional Fairbanks-Morse motors—see your Fairbanks-Morse representative.

**Air-gap dimension is measured parallel to the axis of the shaft as compared to a radial dimension in a conventional machine.*

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • STOKERS • SCALES • MOTORS • GENERATORS
PUMPS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS



Announcing OUR 4th NEW ADDITION

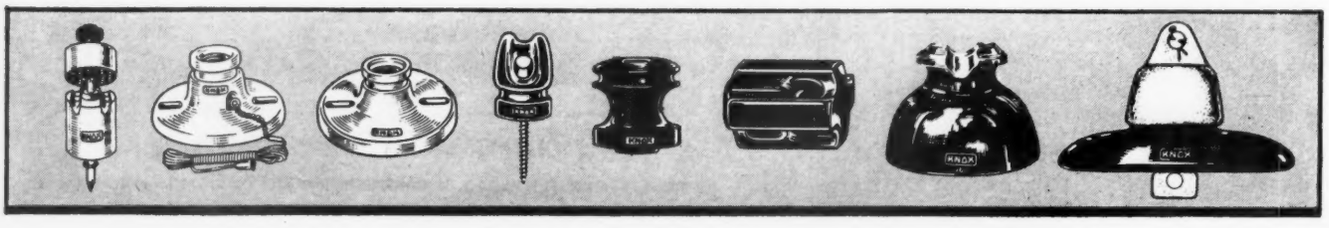
There's been a tremendous new addition at the Knox Porcelain Corporation — 47,000 square feet of steel and concrete structure . . . . another modern oil-fired kiln representing increased capacity of 250%. Kiln No. 2 will be used to produce Pin-types, Guy Strains, Spools, Suspensions, Transformer and Capacitor Bushings and Fuse Boxes. Kiln No. 1 will be used to produce additional Wiring Devices, Neon, Standard, House Brackets and other Insulation.

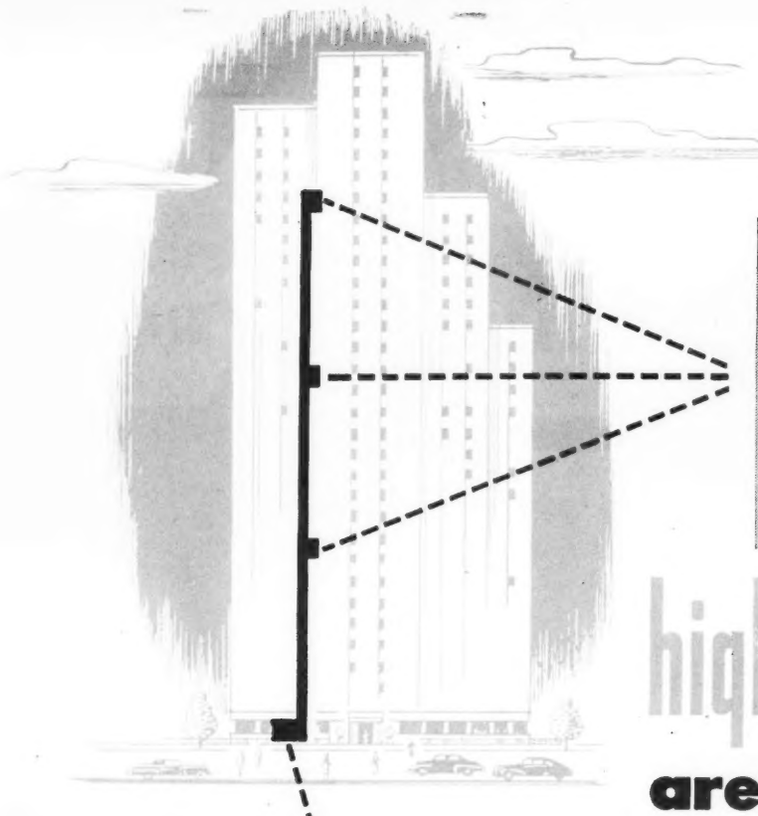
You are invited to visit and inspect the expanded Knox plants and see how quality electrical porcelain is made. Only the finest materials obtainable are used, and production is followed, checked and controlled every step of the way by 4 qualified ceramic engineers. Knox products are built to conform to Underwriters' Laboratories, NEMA and REA specifications. Send for descriptive literature. Main offices, 500-700 Mynders Avenue, Knoxville 11, Tennessee.

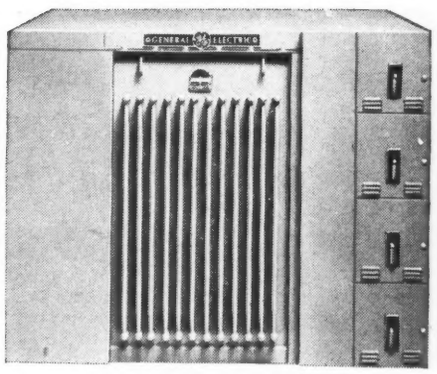
KNOX

KNOX PORCELAIN CORP.
KNOXVILLE, TENN.

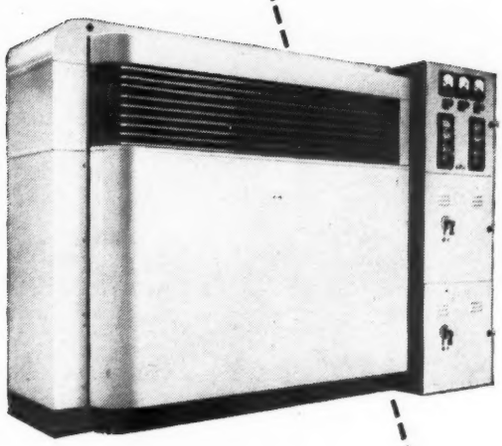
BRANCH OFFICES IN ALL PRINCIPAL CITIES







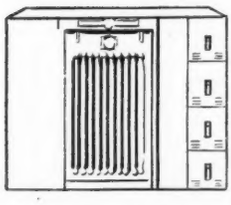
high-voltage runs are low-cost runs



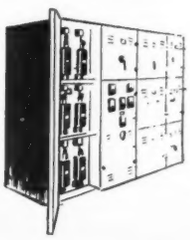
Load-center distribution keeps uneconomical low-voltage cable short, power loss low, voltage regulation high—In fact, here's a power-distribution idea that may bring you almost unbelievable savings in first cost, and at the same time make your system more flexible and expansible. Power is distributed at relatively high voltage to unit substations located *near the load centers.* There it is stepped down to utilization voltage and distributed to the loads via short feeders.

Keeping high-loss secondary feeders *short* means less loss in feeders, better regulation at the load. Having several distribution points in the system (instead of only one at the service entrance) isolates faults, increases service continuity. These are only a few of the advantages of load-center distribution; your nearest G-E sales office will have an application engineer tell you the rest and help you plan your entire distribution system. Call today, or write for **Bulletin GEA-3758, "Load-center Power Distribution."** *Apparatus Dept., General Electric Company, Schenectady, N. Y.*

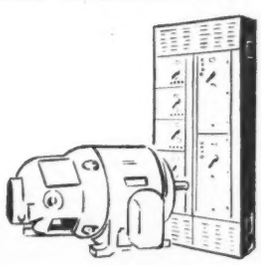
EQUIPMENT FOR COMMERCIAL BUILDING



Power-distribution Systems



Rectifiers for Power Conversion



Motors and Control

GENERAL ELECTRIC

665-104

GEON ON WIRE

RESISTS . . . ozone, wear, sunlight, water, chemicals and most other normally destructive factors.

GIVES YOU . . . 14 colors including NEMA standards.

PROVIDES . . . more conductors for a given space.

HAS . . . excellent electrical properties.

IS . . . easy to draw, easy to strip. And is light in weight.

Wire and cable insulation made from Geon polyvinyl resins is suitable for industrial, manufacturing and utilities wiring. Where the best wire and cable insulation is required, specify Geon by name. For information regarding special applications, write B. F. Goodrich Chemical Company, Department H-8, Rose Building, Cleveland 15, Ohio. In Canada, Kitchener, Ont.

B. F. Goodrich Chemical Company

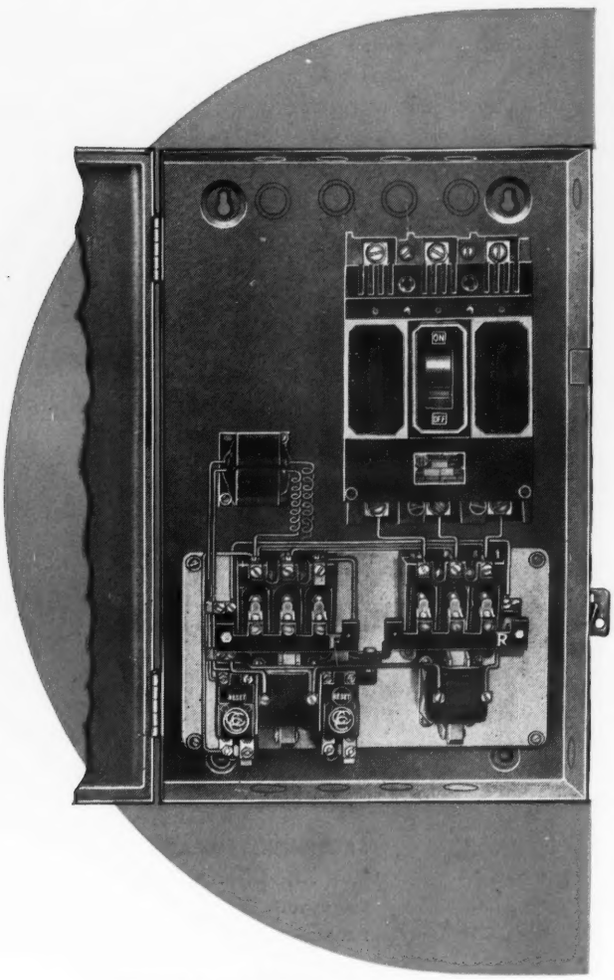
A DIVISION OF THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals

CLARK

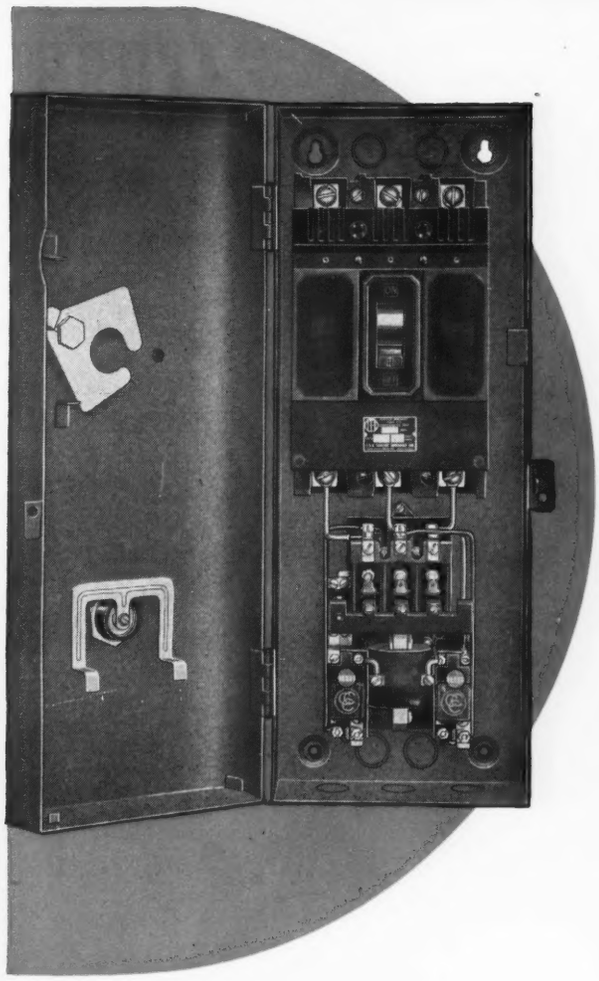
A. C. COMBINATION MAGNETIC STARTERS *with* AIR CIRCUIT BREAKER

...REVERSING *and* NON-REVERSING



CLARK Bulletin 6040 AC reversing, combination across-the-line starters consist of:

1. Two contactors for making or breaking power circuit to motors.
2. A circuit breaker for short circuit protection.
3. A CLARK overload relay for removing motor from line in case of unsafe overloads.



CLARK Bulletin 6020 AC non-reversing, combination across-the-line starters consist of:

1. A contactor for making and breaking power circuit to motor.
2. A circuit breaker for short circuit protection.
3. A CLARK overload relay for removing motor from line in the event of a dangerous overload.

BOTH TYPES are available in sizes 0 through 5 in NEMA Type 1—General Purpose enclosures, NEMA Type 1A—Semi Dust-Tight enclosures, and NEMA Type 5—Dust-Tight enclosures.

Bulletin 6040 starters are also available for Plug-Stop or Jogging Duty (NEMA IC8-21).

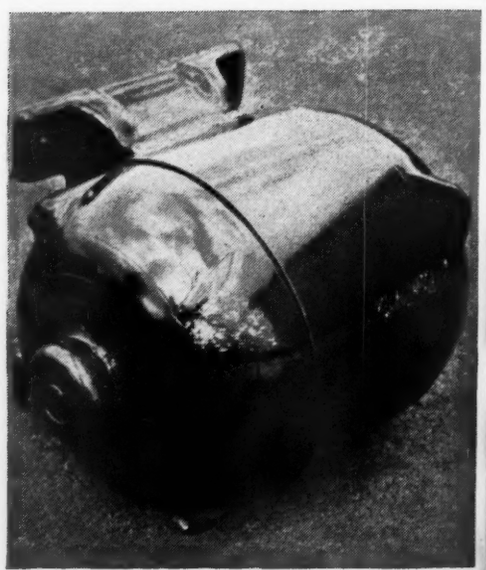
Both starters provide full voltage starting and overload protection for squirrel-cage motors, and can be used as primary switches for wound rotor induction motors.

Write for Descriptive Bulletins 6020 and 6040.

THE CLARK CONTROLLER CO.

EVERYTHING UNDER CONTROL • 1146 EAST 152nd STREET, CLEVELAND 10, OHIO

Life-Line



SMASHING IMPACT caused by dropping this Life-Line motor onto hard concrete pavement failed to do more than mar the finish—a shock test no cast iron can stand.

TERRIFIC PUNISHMENT PROVES STRENGTH OF INDUSTRY'S NEW ALL-STEEL MOTOR!

Over a quarter of a million now in service set best performance record in 58 years of manufacture

Motors seldom have to withstand dropping onto concrete pavement—but they do meet constant stresses and unexpected shocks on almost any job in industry.

The fact that Westinghouse Life-Line motors can withstand such extreme examples of abuse is one of the reasons for the startling records of the more than a quarter million Life-Lines now in service.

The performance record of these units has been six times better than that of any other motor design built by Westinghouse in its 58 years of motor manufacture.

Life-Line's heavy steel construction is one of the benefits that has come to industry out of war experience, when motors built for use on Naval vessels proved the much greater shock resistance of steel over cast iron.

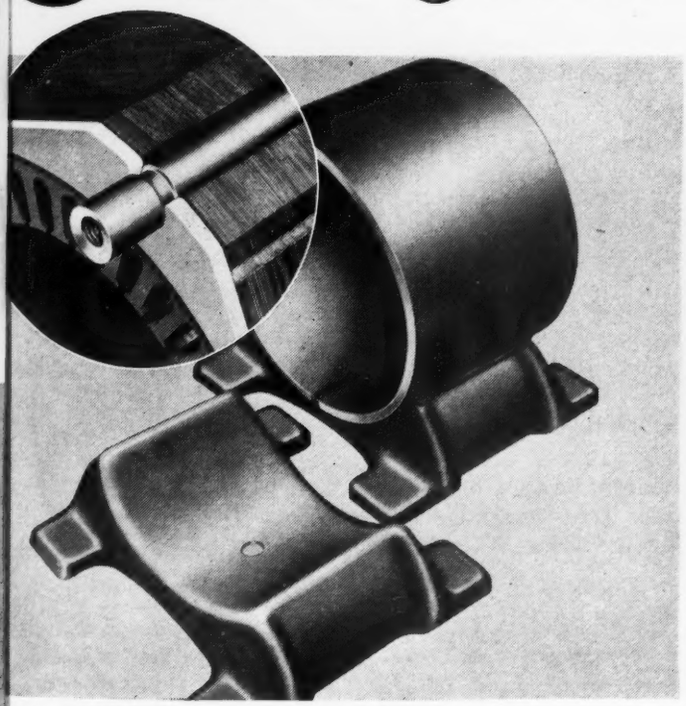
The heavy steel "barrel" frame and "bridge-truss" foot construction has given the motor a rigid, yet resilient structure; at the same time, it has saved as much as 35% in space requirements over other methods of construction. The streamline of the Life-Line blends smoothly with modern machinery.

Get the full facts on Life-Line—its pre-lubricated bearings—its new electrical strength—and the reduced space and weight requirements—they're *all important* gains for your equipment.

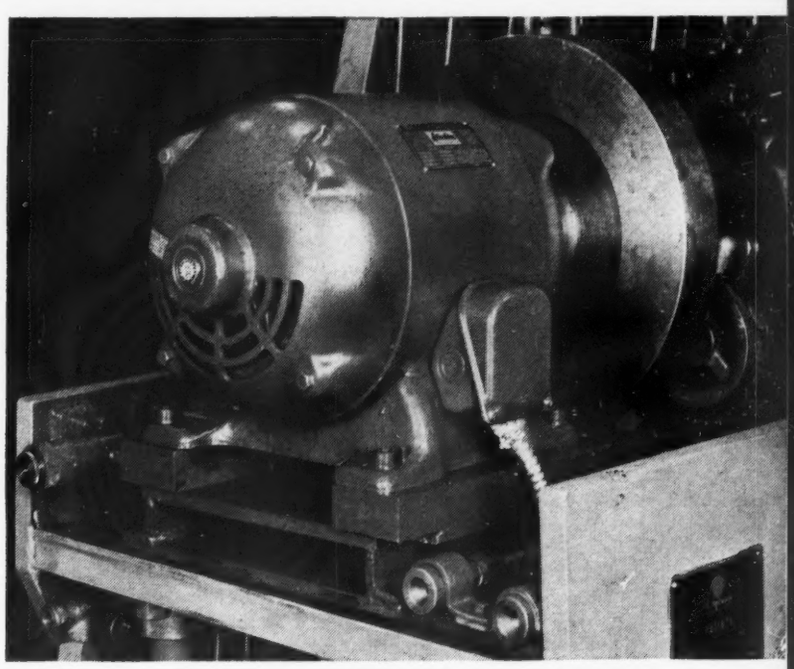
Immediate delivery on standard and near-standard Life-Line motors, from 1 to 15 hp, in dripproof, splashproof and totally-enclosed types; short delivery available on the specials in these frame sizes. The Life-Line design is rapidly being carried through the larger sizes. Check your nearest Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21454

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Life-Line motors



STEEL STRENGTH starts with heavy rolled plate which forms Life-Line motor frame. Brackets and feet are heavy pressed steel. Clamping bars and plates, bearing hubs and even conduit boxes in Life-Line motors, are made of sturdy steel.



TOUGH JOBS—the shock loads of punch presses, drop hammers and other strenuous machine tool applications; these are places where Life-Line's greater resistance to shock means longer life and more trouble-free operation.

Cables run COOL in TRANSITE DUCTS

- **reducing copper losses**
- **increasing current capacity**
- **prolonging insulation life**

TESTS in the J-M Research Laboratory prove that Transite Ducts dissipate heat rapidly—keep cables cool and in this way reduce copper losses and increase current carrying capacity.

Made of asbestos and cement, Transite Ducts are strong, immune to rust and rot. They are incombustible—will not support flame, cause smoke, fumes or explosive gases. Being non-metallic, they are unaffected by electrolysis or galvanic action.

Transite Ducts have a permanently smooth bore that makes possible long cable pulls and easy replacements. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated installations.

For full information on Transite Ducts, write for Data Sheet DS-410. Johns-Manville, Box 290, New York 16, N. Y.

JOHNS MANVILLE JM PRODUCTS

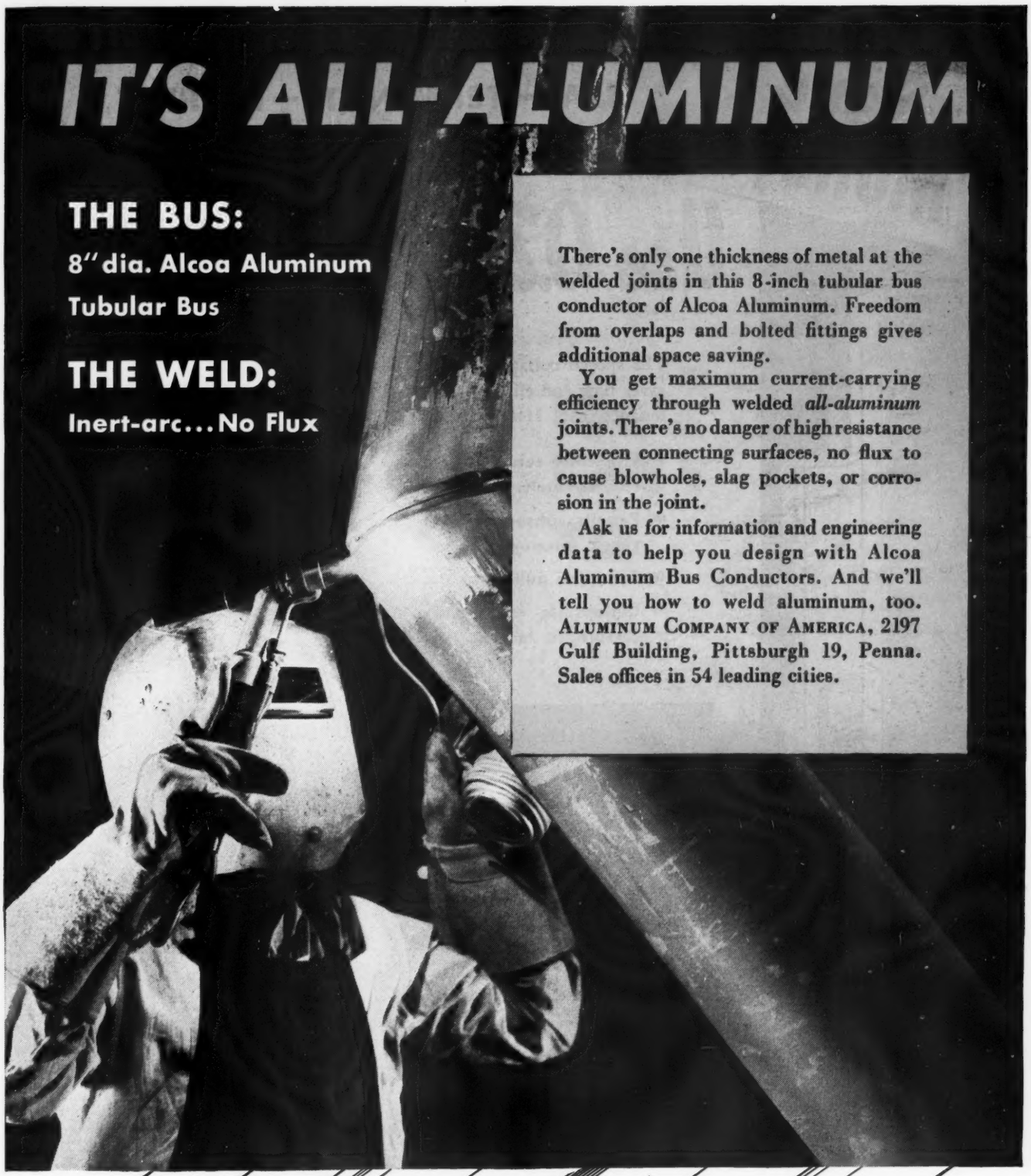
Johns-Manville

TRANSITE DUCTS

CONDUIT for use without concrete

KORDUCT for concreting in

IT'S ALL-ALUMINUM



THE BUS:

8" dia. Alcoa Aluminum Tubular Bus

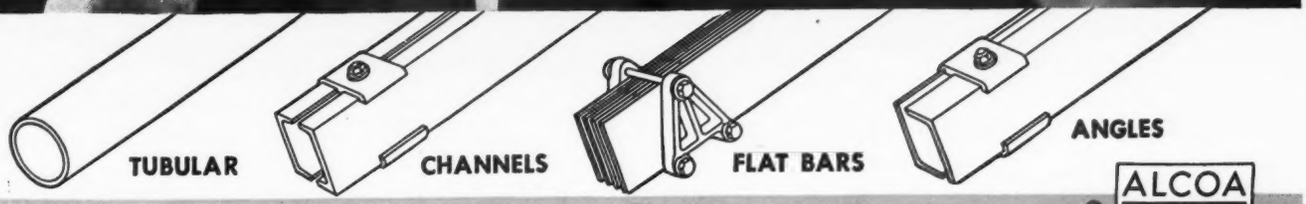
THE WELD:

Inert-arc... No Flux

There's only one thickness of metal at the welded joints in this 8-inch tubular bus conductor of Alcoa Aluminum. Freedom from overlaps and bolted fittings gives additional space saving.

You get maximum current-carrying efficiency through welded *all-aluminum* joints. There's no danger of high resistance between connecting surfaces, no flux to cause blowholes, slag pockets, or corrosion in the joint.

Ask us for information and engineering data to help you design with Alcoa Aluminum Bus Conductors. And we'll tell you how to weld aluminum, too. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh 19, Penna. Sales offices in 54 leading cities.



ALCOA ALUMINUM BUS CONDUCTORS

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

Save Money!

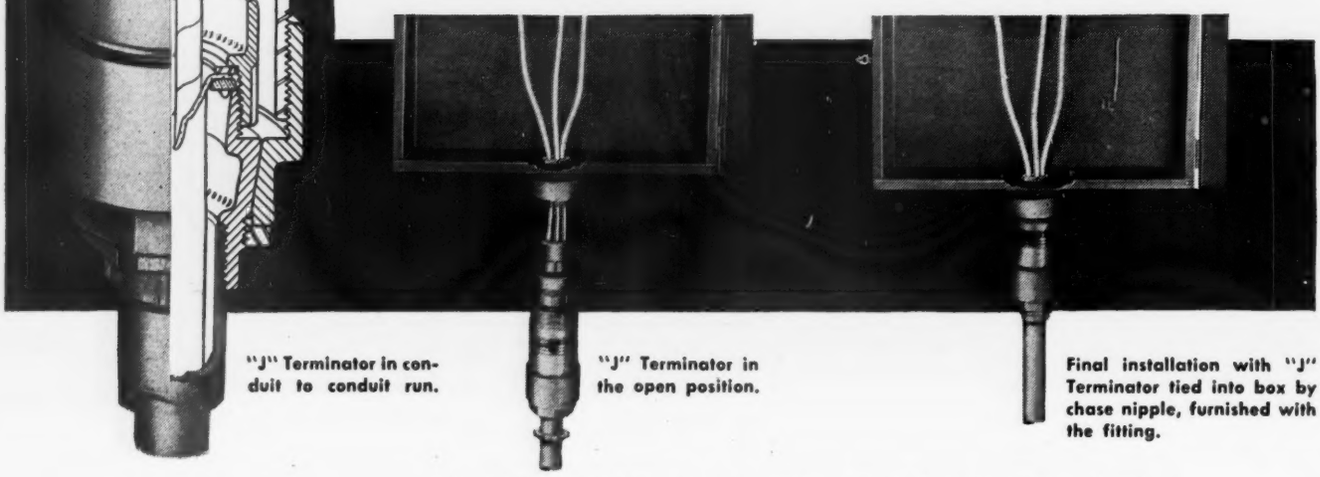
SEAL—TERMINATE—INSPECT

without disturbing other equipment

Use O.Z. "J" Terminators

The special collapsible design feature of O.Z. "J" Terminators saves time and effort in electrical installations . . . reduces maintenance costs. Here's how the "J" Terminator saves you money:

- **Efficiently seals and terminates conduits and cables outside cabinets.**
- **Permits subsequent inspections or current checks without circuit interruption by merely dropping sleeve.**
- **Serves as pulling and splicing chamber.**
- **Collapsible feature permits terminating conduit at enclosure, or terminating conduit and then continuing run.**



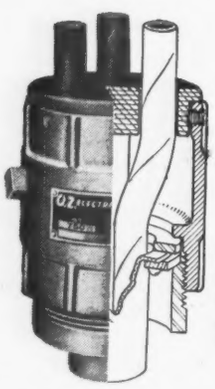
"J" Terminator in conduit to conduit run.

"J" Terminator in the open position.

Final installation with "J" Terminator tied into box by chase nipple, furnished with the fitting.

In addition to the "J", O.Z. makes a complete line of terminating potheads, compound bushings and sealing bushings for lead and rubber-covered, braided, and armored cables. With these designs, it is possible to meet all industrial requirements.

When special equipment is needed, our engineering department is prepared to cooperate with you. Write O.Z.'s Service Manager now, for a detailed catalog of electrical fittings.



TYPE "CLC" TERMINATING POTHEAD. A compact terminator designed for lead-covered cable. It seals the cable and grounds the lead sheath. Body of fitting screws directly on the conduit.

THEY'RE O. K. IF THEY'RE O. Z.

CONDUIT FITTINGS · CAST IRON BOXES · SOLDERLESS CONNECTORS
CABLE TERMINATORS · GROUNDING DEVICES · POWER CONNECTORS

O.Z. ELECTRICAL MANUFACTURING COMPANY

262 BOND STREET · BROOKLYN 2, N. Y.

4286

He Knows CENTRAL SPANS CONDUIT IS EASY TO Cut

Yes, sir! Saw teeth really bite in and cut through Central Conduit fast. It's easy to cut because it's made from Spang CW . . . the pipe that's remarkably free from hard spots that slows cutting and dulls tools.

What's more, Central is rigid steel conduit. And that's the only type approved by the National Electrical Code as moisture, vapor and dust tight for use in hazardous locations and occupancies.

Central Rigid Steel Conduit is handled by a distributor near you. In spite of shortages he will do everything possible to fill your orders.

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

SPANG-CHALFANT

1828 *Our 120th Anniversary* 1948

Division of The National Supply Company
General Sales Office: Grant Bldg., Pittsburgh 30, Penna.
District Offices and Sales Representatives in Principal Cities

SERVIT

listed by

Underwriters' Laboratories, Inc.

(SIZES #8 THROUGH 4/0)

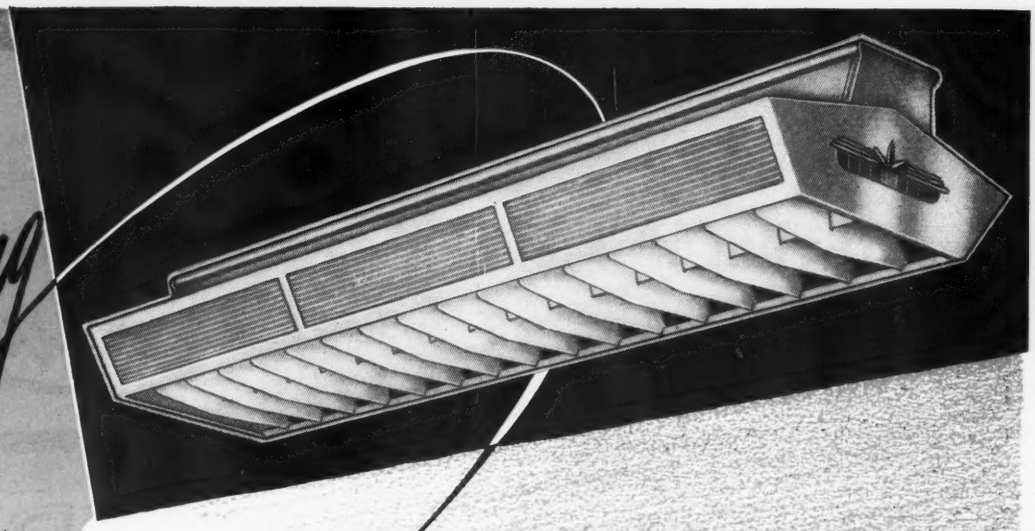
This universal favorite for taps, dead ends, service entrances, motor leads, etc., is now UL listed for the sizes indicated . . . and each size is listed for all practical combinations of cable sizes. In addition, SERVIT'S compactness, its high compressional strength, and its rounded, easily taped edges . . . all contribute to its outstanding leadership. For an efficient, approved connection, be sure to connect with Burndy.

Connect with

BURNDY

New York 54, N. Y.

WESTERN BRANCH: Vernon 11, Calif. • CANADA: Canadian Line Materials, Ltd., Toronto 13 • FOREIGN: Philips Export Corp., N. Y. 17, N. Y.



Introducing

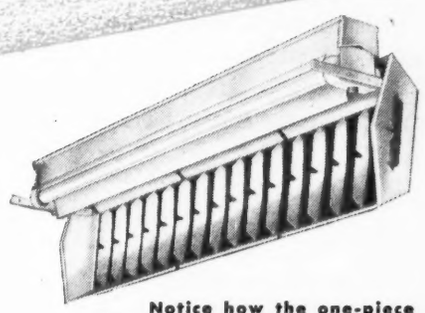
THE NEW WHEELER COMMERCIAL TURRET LINE FIXTURE

"EASY ON THE EYES. TWO WAYS"... that's what they are saying about this new Wheeler fluorescent fixture for schools, offices, hospitals, stores and public buildings! It has modern styling that blends perfectly with modern architecture... scientific designing that reduces glare in the line of vision and on the ceiling. Every factor for correct lighting is embodied in its design.

This new fixture features... durable, easy-to-clean baked enamel finish; latest type Turret Sockets; special top shield that eliminates "hot spot"; rugged, one-piece louver body on hinges; inside channel track for socket and clamps. This unit is available for individual mounting or continuous runs; surface ceiling or pendant mounting; 3½" lamp spacing.

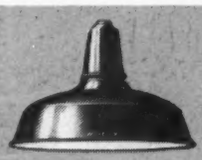
Here's the latest product of Wheeler "Skilled Lighting". Good looking! Good seeing! Sturdy! Easy-to-maintain! Write for full details. **Wheeler Reflector Company, 275 Congress St., Boston 10, Massachusetts.**

Distributed exclusively through electrical wholesalers.



Notice how the one-piece louver body swings open... from either side. Simplifies servicing.

New G. E. Turret Lampholders provide spring tension that holds lamps securely. Lamps easily installed or removed without danger of breaking sockets.



OTHER "SKILLED LIGHTING" FIXTURES

There's a Wheeler Incandescent or Fluorescent fixture to meet every industrial requirement.

Wheeler REFLECTORS

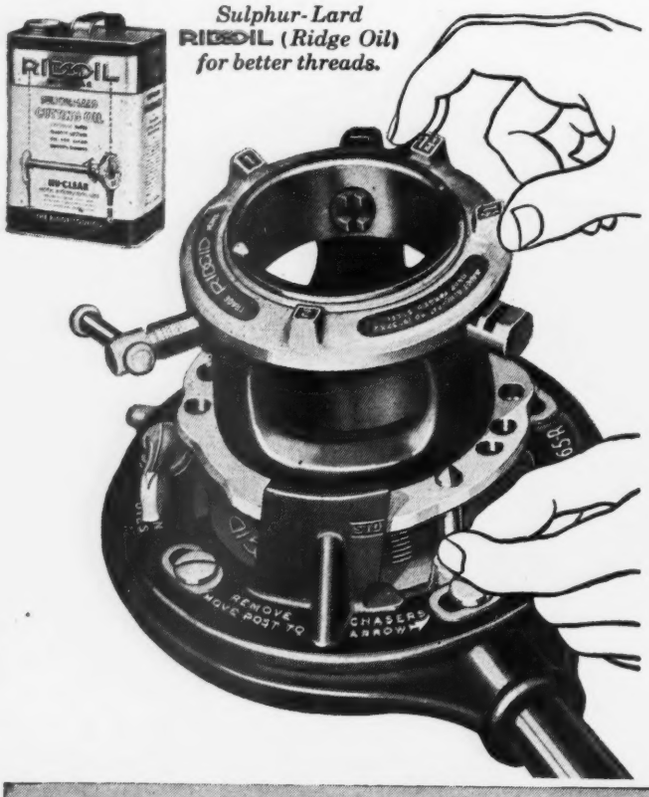
SKILLED LIGHTING

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

Ready TO THREAD PIPE QUICK-AS-A-WINK

RIDGID No. 65R gives you fast get-ready, perfect threads on 1" to 2" pipe

● It's all set to size in just 10 seconds to cut perfect pipe threads on 1," 1¼," 1½" or 2" pipe. Workholder sets instantly—only 1 screw to tighten on pipe—no bushings. RIDGID 65R is self-contained, no extra dies to haul around or lose. Fast accurate threads on iron, steel, brass or copper pipe or conduit, with surprisingly little effort. Every 65R is factory-tested—see test sample in each new tool. Buy from your Supply House.



Sulphur-Lard RIDOIL *(Ridge Oil) for better threads.*

No PIPE WRENCH HOUSING EXPENSE *-ever*

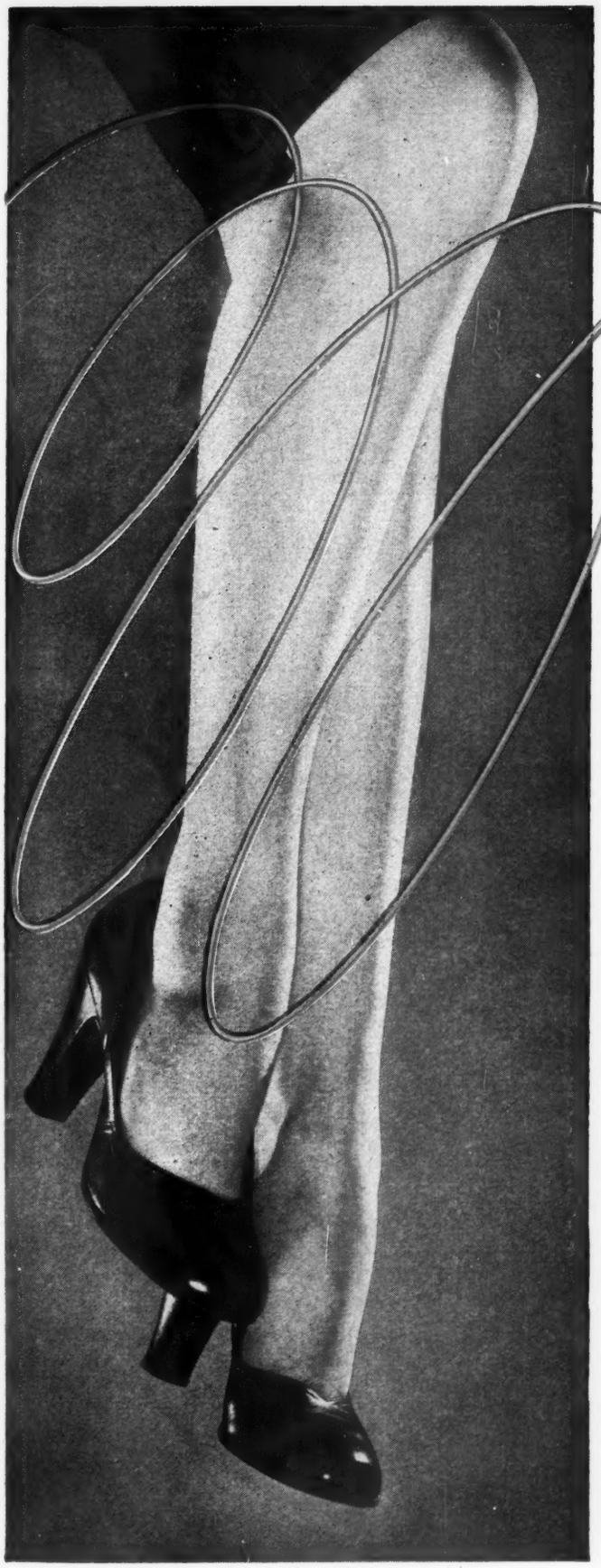
RIDGID economy guaranteed . . . and you like its work-saver features, too

● The RIDGID housing guarantee is just one of the reasons why the RIDGID heavy-duty pipe wrench is the favorite of men who know fine tools—all over the world. Note the easier-work features: adjusting nut in open housing spins easily in all sizes 6" to 60"; handy pipe scale on hookjaw; instant-action non-slip non-lock jaws; powerful comfort-grip I-beam handle. No wonder RIDGIDs are the most popular pipe wrenches made. You'll prefer them, too. Buy them at your Supply House.

Handy end wrench for pipe in coils or against flat surfaces.

RIDGID WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO



a modern new wire dressed in nylon

This quality branch circuit wire is called Neolay* (Type RU). It is the finest wire ever made.

Why? First it has a nylon covering, for smooth, easy pulling. Moreover, nylon is tough and resists the deteriorating action of oil and gasoline. The insulation of Neolay RU is a combination of Laytex* (90% pure rubber) and Neoprene. That is why it has such a small diameter and light weight, and such superior electrical and physical properties. For example, a chain of 20 gas stations formerly had to change wiring systems every Spring, because of severe damage caused by moisture. After switching to Neolay, these changes were eliminated.

For free sample and additional information write to Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

*Reg. U. S. Pat. Off.

A PRODUCT OF

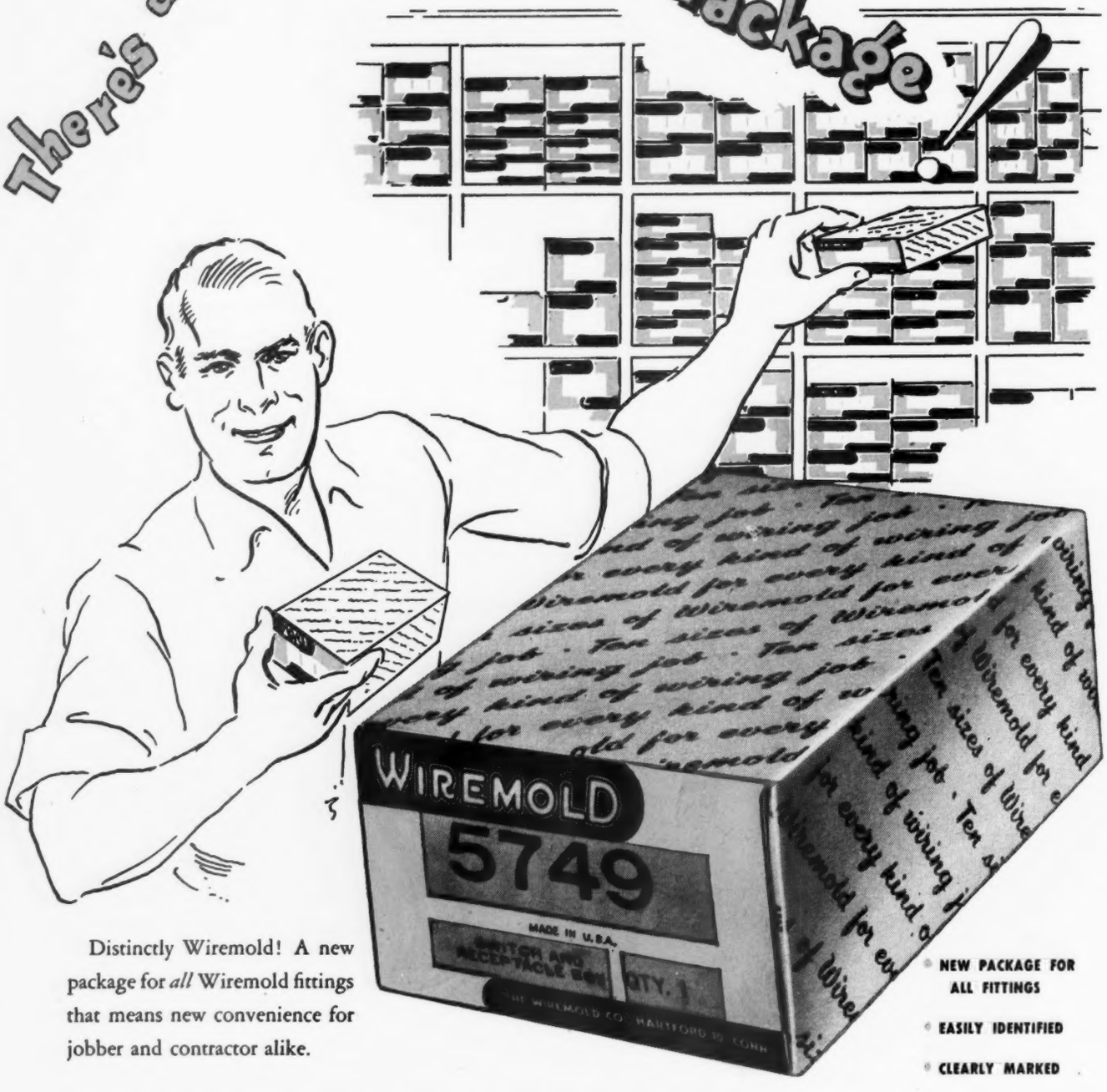
U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

A WIRE IS ONLY AS GOOD AS ITS INSULATION

Wires made by U. S. Rubber are Laytex Insulated

There's a WIREMOLD Fitting for every wiring job... in a new Package!



Distinctly Wiremold! A new package for *all* Wiremold fittings that means new convenience for jobber and contractor alike.

- NEW PACKAGE FOR ALL FITTINGS
- EASILY IDENTIFIED
- CLEARLY MARKED
- SIMPLIFIES STOCKING
- HANDY ON THE JOB
- ATTRACTIVE
- DURABLE

Easy to spot on the shelf . . . helps to solve the stock problem. Clearly identified with fitting name, number and quantity . . . assures getting the *right* fitting for the specific job.

Distinct advantages . . . *distinctly Wiremold!*

THE WIREMOLD COMPANY

HARTFORD 10, CONN.

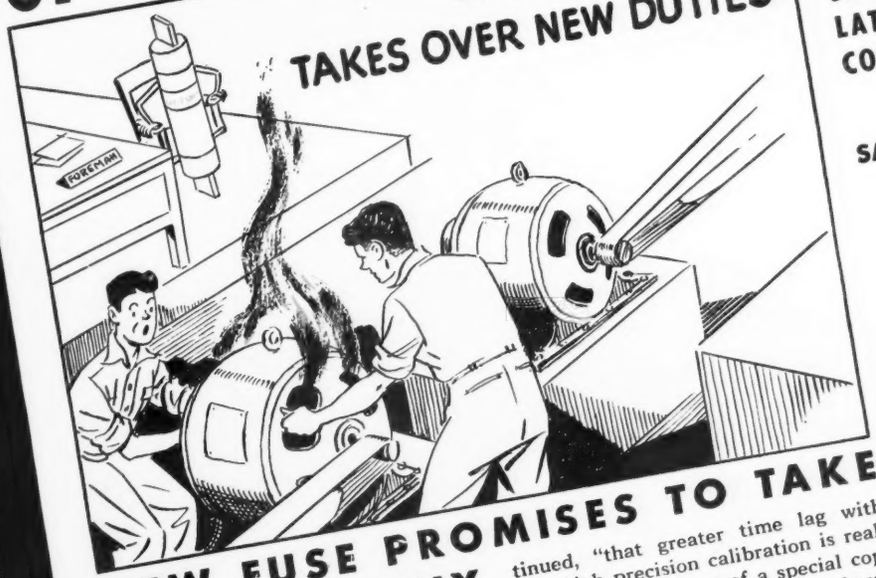
14WM48

"Correct Fuse Protection Is As Much a matter of TIME as of OVERLOAD".

Jefferson Electric News

SAF-T-LAG TAKES OVER AS RESULT OF BIG PLANT "BLOWOUT" . . . !

SAF-T-LAG FUSE TAKES OVER NEW DUTIES



"THERE'LL BE NO MORE SUCH SHEN-AN-IGANS!" EXCLAIMS SAF-T-LAG FUSE AS INSTALLATION PROCEEDINGS ARE COMPLETED.

SAF-T-LAG FUSE Calls Burned-out Motors Poor Production Relations Job

NEW FUSE PROMISES TO TAKE THINGS COOLLY

As a climax to several costly production delays resulting in slowdown of order filling and complaints from the field, the _____ Plant has brought in an expert from the Jefferson Electric Company to stop such "blowouts" as occurred recently in which all company motors took part. The first official act of SAF-T-LAG was to remove all inadequate fuses from their positions, replacing them with proper load-rated Saf-T-Lag associates. Company President Mr. _____, in an official statement emphasized: "The new Saf-T-Lag Thermal Fuse will give us *measured protection* against costly work stoppages due to un-called-for blowouts,—and against motor burn-outs".

"I understand," the president continued, "that greater time lag with new high precision calibration is realized through the use of a special copper alloy trigger spring. This circuit opening spring is strong, simple and positive".

Complete Story on Saf-T-Lag Thermal Fuse Now Available

Jefferson Electric officials report that proper fuse selection has been made easy by a handy "Rating Chart" enclosed with new Fuse Folder 482-ST. A copy will be sent promptly upon request.

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

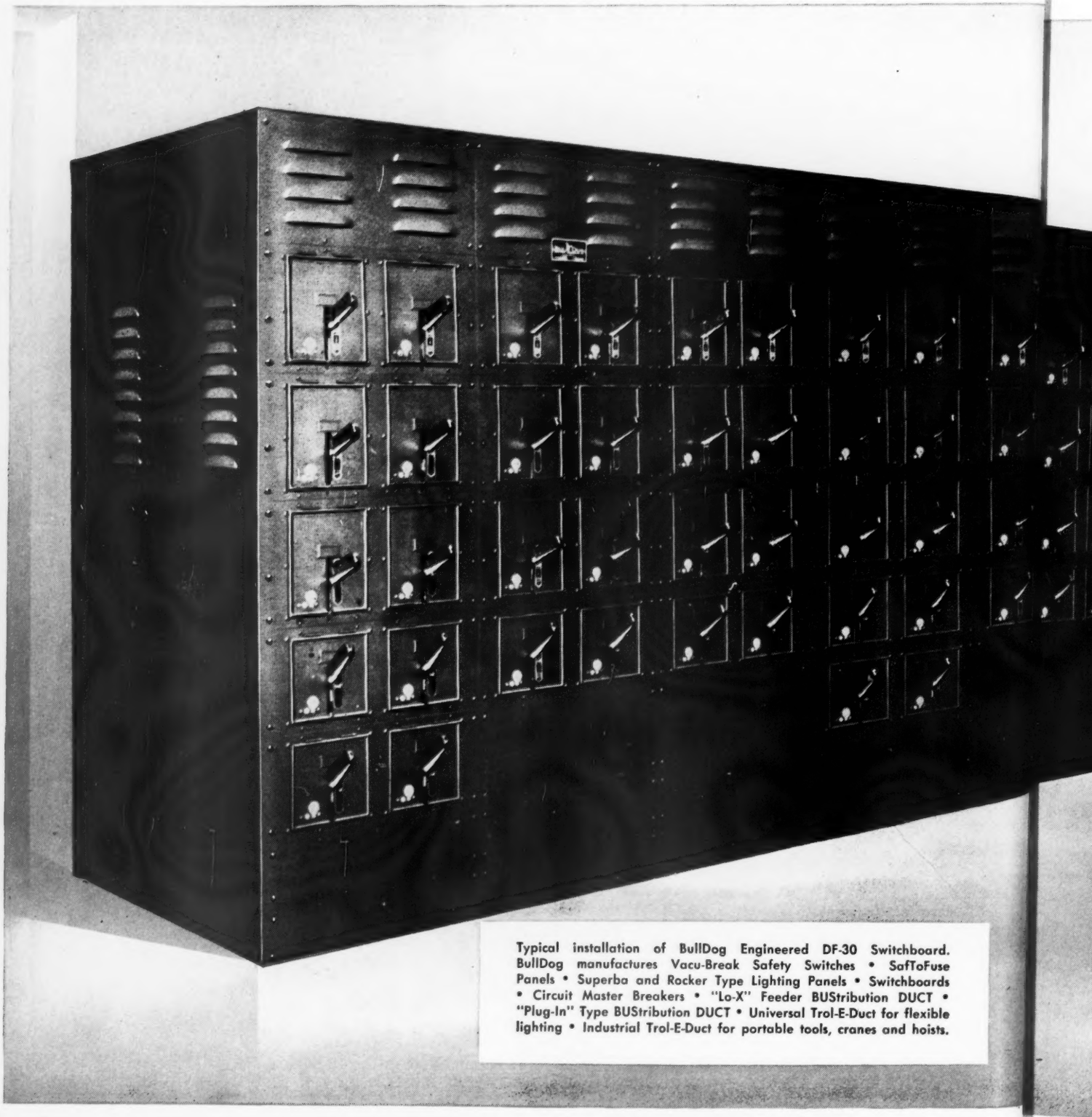
In Canada:
Canadian Jefferson Electric Co., Ltd.,
384 Pape Avenue, Toronto, Ontario

JEFFERSON SAF-T-LAG *Thermal* FUSE

Sold Through Wholesalers.

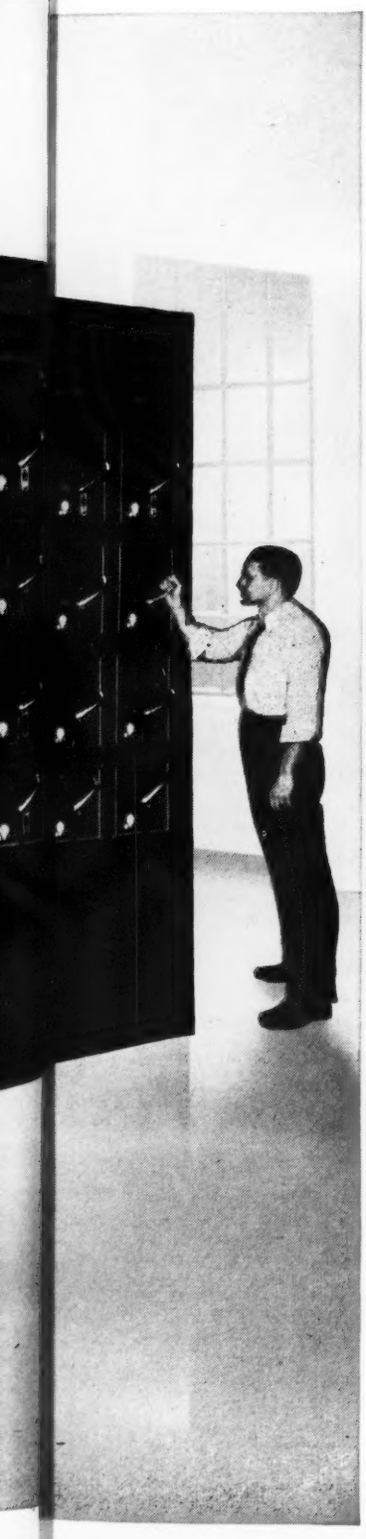
A good way for contractors t

BullDog's Field Engineers welcome the opportunity of discussing layouts with Electrical Contractors in the early planning stages of a building project. Their special knowledge and experience frequently contribute to an outstanding electrical distribution layout . . . and mean savings in installation and maintenance costs, as well as highest efficiency and reliability in actual operation. Why not take advantage of this preplanning service?



Typical installation of BullDog Engineered DF-30 Switchboard. BullDog manufactures Vacu-Break Safety Switches • SafToFuse Panels • Superba and Rocker Type Lighting Panels • Switchboards • Circuit Master Breakers • "Lo-X" Feeder BUStribution DUCT • "Plug-In" Type BUStribution DUCT • Universal Trol-E-Duct for flexible lighting • Industrial Trol-E-Duct for portable tools, cranes and hoists.

s to build future sales



EVERY BullDog DF-30 type main switchboard you install ends a lot of headaches for clients—and builds future sales for you!

The BullDog DF-30 SAFtoSWITCHBOARD is a compact unit that gives finger-tip control of an entire plant.

Spare space for future requirements can be provided. Switch units are interchangeable, and can be rearranged to meet changing plant needs. Provisions can also be made for main circuit-breaker protection, transformers and metering equipment.

Switching is safe

Switch units are the famous DF-30 SAFtoSWITCHES. They're approved by Underwriters for all sizes from 30 to 1200 amperes, 600 volts and less.

Ball-bearing action of the switch units *reduces friction and maintenance.* Quick, simultaneous double-break reduces arcing. When thrown OFF, both "line" and "load" sides are disconnected. There's no possibility of feed-backs with a BullDog DF-30 SAFtoSWITCHBOARD.

Get all the facts about the DF-30 from your nearby BullDog Field Engineer. Let him point out how this switchboard serves your clients in a way that helps maintain your reputation as a good contractor.

* * *

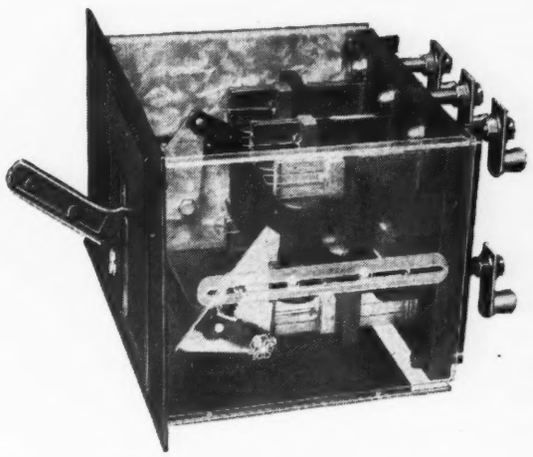
The story of this DF-30 Switchboard is being told regularly through 11 trade publications that reach more than 316,931 prospects. The stage is being set through advertising to help you make more sales.

BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN—FIELD OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

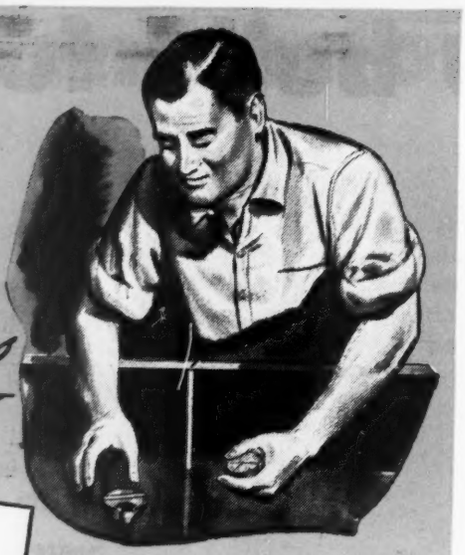
Phantom view of DF-30 SAFtoSWITCH Unit, showing the frictionless ball-bearing guide mechanism. Separate fuse and switch compartments prevent accidental contact with live parts while replacing fuses. In OFF position fuses are disconnected from "line" and "load."



BULLDOG

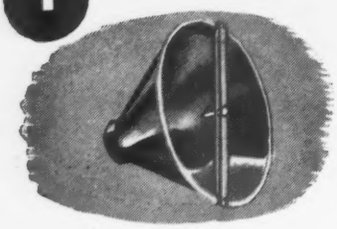
HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

Here's the easiest way to determine VISCOSITY...



just 3 simple steps

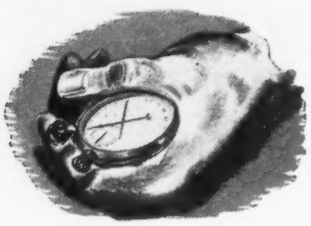
1



USE A DEMMLER CUP...

Viscosity is measured simply by placing the Demmler Viscosimeter in the varnish (or other liquid) and allowing it to settle under its own weight. Varnish enters cup through opening at the bottom.

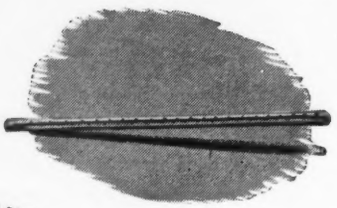
2



A STOP WATCH...

Viscosity is determined by the number of seconds elapsed from the time the tip enters the varnish, until the inflowing material touches the pointer near the top.

3



AND A THERMOMETER

A thermometer is needed to record the temperature of the varnish. Varnish viscosity varies with the temperature, and temperature variations must be adjusted to equivalent viscosity at 25°C.

Westinghouse offers a quicker, easier way to test the viscosity of electrical insulating varnishes. Using the Demmler Viscosimeter, developed by Westinghouse, operators can make the tests right *in the mixing tank* or varnish cans.

It consists of a cone-shaped brass cup, accurately calibrated for content and weight. A small opening in the bottom permits entry of varnish . . . a pointer near the top tells when to stop. It is supplied in two types, No. 1 and No. 10, both of equal size, but with differences in tip opening. No. 10 is especially for heavier liquids, and sinks ten times as rapidly as the No. 1. Available at cost ($10.00 each).

Call or write your near-by Westinghouse distributor . . . to place your order or obtain more information. Also, ask for Bulletin 65-120 which gives helpful viscosity data and describes the complete line of Tuffernell Insulating Varnishes. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-06412

TUFFERNELL INSULATING VARNISHES

. . . for every electrical need

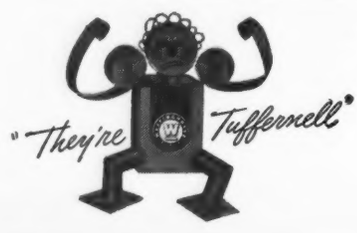
Westinghouse offers the electrical industry a complete line of insulating varnishes . . . a type for every requirement. Each is formulated to meet specific operating requirements . . . job-proved in extensive field applications . . . backed by the Westinghouse guarantee.

For best results, use Tuffernell!

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

TUFFERNELL INSULATING VARNISHES



AUGUST . . . . at a Glance

Big Jobs

Big electrical construction projects are a source of many practical and useful techniques. Sheer size is not always important. But big jobs logically concentrate a number of electrical problems and their solution is one vast project. Foley's of Houston, one of America's greatest mercantile establishments, is described from the electrical viewpoint beginning on page 49. It incorporates many modern features of structure and electrical design and, in the process, many useful ideas and methods to guide and inspire ingenious wiring applications in other jobs and other places.

Priority

Traditionally, electrical work is shoved into last place when space is allocated for risers and equipment. Once it was reasonable. Other pipe trades involved bigger work and more critical fitting. Today the electrical work may require as much space or more than plumbing and heating piping. Convenient access to the system can be more important. A good many antique procedural rules that persist in specifications need a thorough overhauling to give the electricals at least an even break in space priority.

Construction Trends

Department of Commerce statistics on construction activity indicate that 1948 dollar volume will go far beyond the record set in 1947. First 5 months of '48 were $6,083 million more than one third again as great as the corresponding period of 1947. Even though about half the increase reflects rising costs, there's about 18 percent net increase in physical volume.

Volume gains in '48 have been substantially greater than even the more optimistic forecasts at the beginning of the year. Housing not under construction is pushing against the 100,000 units per month mark with possibility that 1948 will make an all time record in residential construction.

Lighting Sales Methods

Modern illumination design and practical lighting application involve a nice balance of able engineering and effective sales effort. Both are important. Characteristically, planned lighting efforts have been predominantly on the engineering side. The techniques of planned lighting are widely known in all branches of the electrical industry. Sales-wise the situation is not so good. There is still much to be done about effective market development and sales techniques.

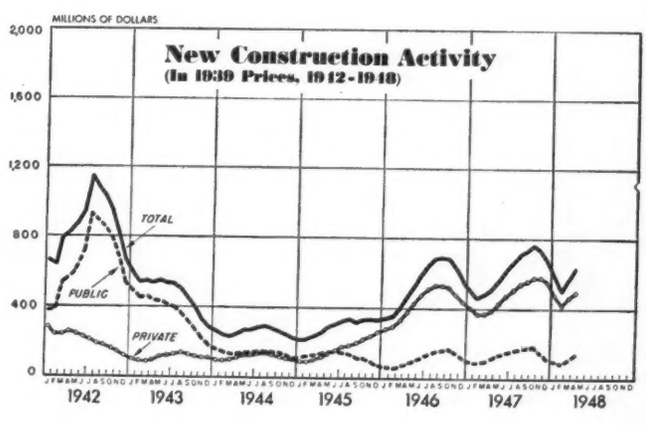
In our September issue an editorial feature section "Selling Planned Lighting" will present a well organized development of lighting markets, values and sales techniques. It will contain much new data and useful guidance for everyone concerned with lighting sales.

Power Distribution

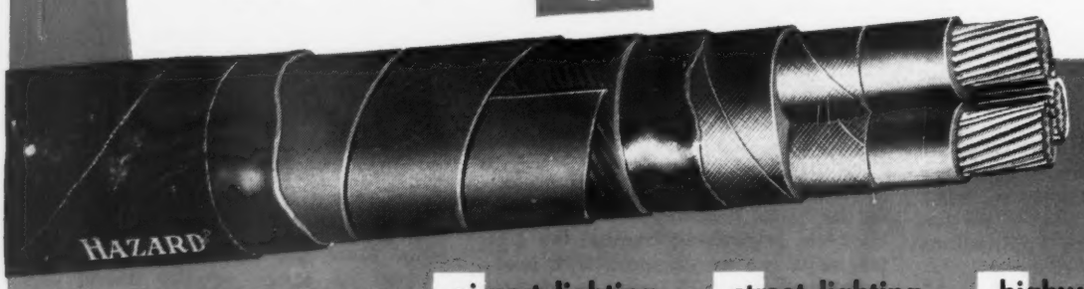
Power distribution in the oil fields is a large part of total electrification costs. Many of the problems encountered are unique in oil field work, but as in most specialized electrical problems, there are ideas and methods which can prove equally useful in other types of work. In "Oil Field Power Distribution," beginning on page 81, W. C. Bloomquist discusses system planning and cost data in the first of a series on this interesting area of electrical work.

Cutting Lost Motion

Key to profitable small motor business is a critical control of shop methods and costs. Pre-formed coils, pre-cut insulation and attention to details can reduce much expensive lost motion. Gus Eckel's article "Short Cuts to Shop Profits" beginning on page 66 is a practical case study on profitable small motor repairs.



SAVE 4 WAYS WITH HAZARD ARMORTITE CABLE ON THESE 6 IMPORTANT JOBS:



airport lighting . . . street lighting . . . highway lighting . . .
open air theater lighting . . . athletic field lighting . . . power feeders between buildings

Lower initial cost. Because Armortite Cable requires no costly lead sheath or metal armor for protection, you make substantial savings on the purchase of cable.

Direct burial. All the necessary protection for direct burial is built into the cable itself. Duct costs are eliminated. Long-lived, moisture-proof Hazard Watertite Submarine insulation safeguards the conductors electrically. Then a double layer of age-resisting, leather-like tape, plastic sealing compound and saturated jute coverings give Armortite its outstanding non-metallic protection against mechanical damage and the other potential enemies to cable buried direct in the soil.

Fast, easy installation. The light weight, and simple construction of this non-metallic underground cable speeds up handling, makes splicing and terminating easier — gives you important installation savings.

Long, trouble-free service. Years and years of experience have proved that you can forget Hazard Armortite Cable, once it's buried. It continues to carry the load day in and day out with none of those costly, annoying service interruptions. Since 1926, Armortite has set records for long, trouble-free underground cable service. And today, it is made with another improvement that will extend this service even longer. Okobestoprene Tape (asbestos fibres compounded with neoprene) is wrapped over the insulated conductors instead of braid. This provides an additional seal against possible wicking-in of moisture at terminals or joints . . . extra resistance to mildew, acids, flame or alkali . . . permanent circuit identification.

For all the details about this outstanding underground cable, ask your Hazard representative or write Hazard Insulated Wire Works, Wilkes-Barre, Pa.

HAZARD

6860

insulated wires and cables for every electrical use

DUAL DISTRIBUTION

FOR MANY YEARS merchandising establishments have been heading toward windowless layouts. Daylight is blocked out. Sales activity is built around artificial lighting. Electrical systems carry an increasing responsibility. Still the trends in system design have moved toward simplicity in wiring layout and toward grouping and consolidating major elements in the distribution system.

SIMPLICITY IN WIRING layout usually carries the risk that possible electrical failure can have serious effects. Emergency circuits and supply can provide light to safely clear the areas involved. Though safety is assured, and provisions for such safety should be made whatever wiring system is used, it is small comfort to a large commercial enterprise where losses mount at astronomical rates when the lights go out.

A NEW WIRING scheme is appearing in large department stores that may mark an important trend in wiring progress. Foley's of Houston is an example. Dual distribution systems serve major sales areas through two distinct sets of feeders and branch circuits. Alternate rows of lighting fixtures are connected on each of the two systems.

DUAL DISTRIBUTION offers a practical and economical method of assuring reliable continuity of light and power. A complete breakdown of either system would only reduce lighting to half normal value, and leave half the elevator service, ventilation and other power equipment in normal operation.

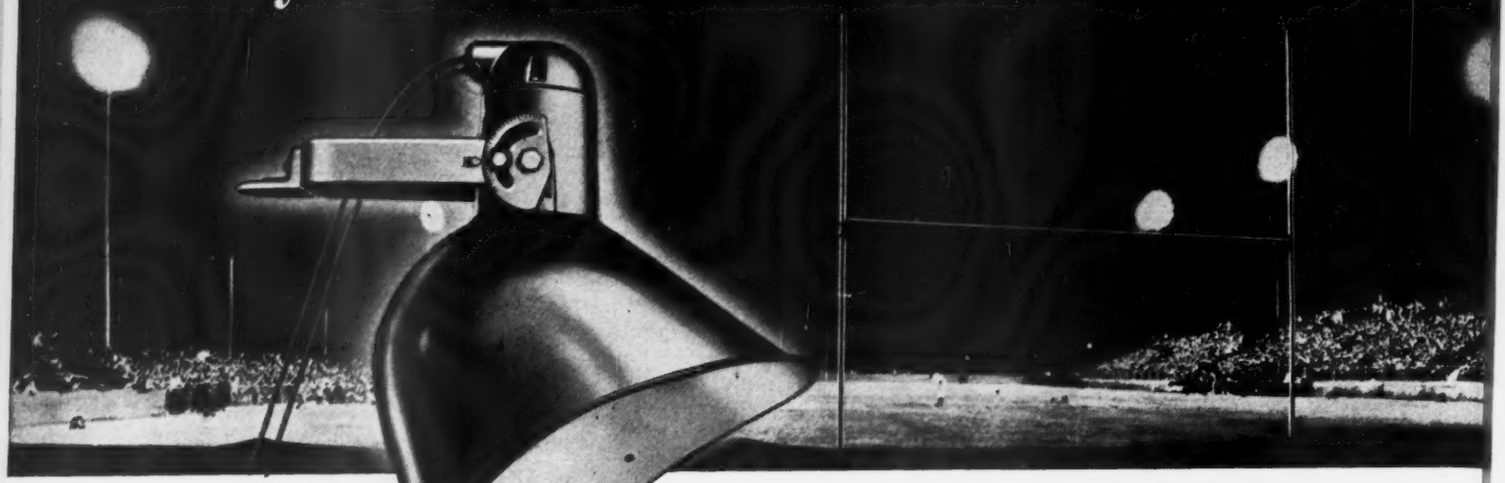
PROTECTION AGAINST major breakdowns is no more important, however, than the protection of individual departments and floors against electrical failure. With dual distribution, circuit protection devices can operate on overload and breakdown with little or no interruption of normal activity in the department.

THE APPLICATIONS of dual distribution are not limited to large projects. The system is equally practical for small stores, amusement centers, institutions or wherever reliability of light and power is important. Cost considerations are not critical since the load is divided over the systems and there is no duplication of capacity or facilities.

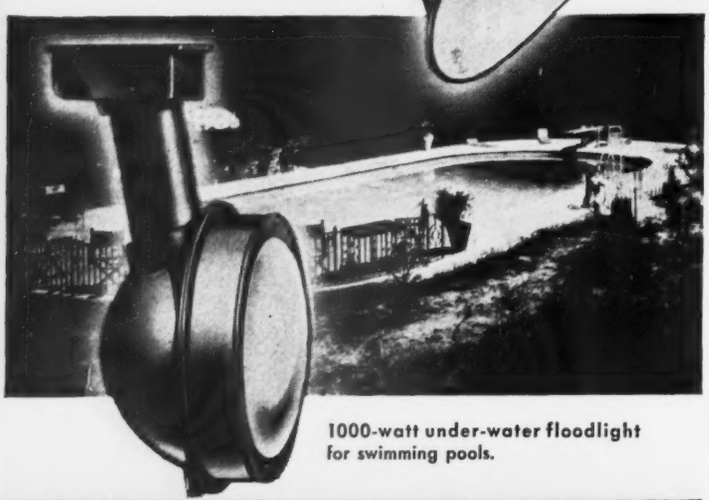
DIVIDING LOADS systematically to limit the effects of electrical failure is not new in principle. Its application on such a large scale as an entire department store, however, is a significant departure from conventional design practice. It clearly emphasizes the tremendously responsible role of electric light and power in modern merchandising administration and operation.

Wm. F. Stuart

GraybaR HAS EVERYTHING YOU NEED FOR



Porcelain-enameled floodlight with elliptical reflector. 750-1000 watts.



1000-watt under-water floodlight for swimming pools.

General-purpose floodlight, available in a range of sizes via Graybar.

...Outdoor Sports Lighting

Night games in all sports are growing more popular. Moder lighting equipment is in demand for both commercial an public parks and playgrounds. Industrial companies are pro viding night sports for employees. Schools, colleges, and estat owners are increasingly interested in better lighting for outdoo recreation.

Electrical contractors can most easily turn this business t profit with the equipment, supplies, and assistance Grayba provides. We distribute leading lines of lighting fixtures . . G-E lamps . . . plus all the accessories, wiring supplies and too you need for the job — whether for night football, baseba hockey, swimming, tennis, golf, or any other game.

When you check your lighting plans and equipment selec tions with your near-by Graybar Lighting Specialist, he bring you the background of our experience in working out lightin plans for every type of outdoor recreation — from sandlot sof ball to major-league baseball.

Check around your community for outdoor lighting oppo tunities. Then call or write our local office for a copy of th Outdoor Recreation Lighting bulletin and for informatio about prices, deliveries. For big job or little, we'll be happ to help you in all the ways we can. *Graybar Electri Company, Inc. Executive offices: Graybar Buildin New York 17, New York.*

Everything for Lighting Via GraybaR

...DISTRIBUTOR OF 100,000 ELECTRICAL ITEMS IN OVER 100 PRINCIPAL CIT

NEW CONCEPTS in functional design, construction and electrical service are combined in this trend-setting merchandising center.

FOLEY'S ... of HOUSTON

Dual electrical distribution, motorized merchandise conveyors, structural innovations and functional floor planning are features of this modern, windowless, completely air conditioned department store.

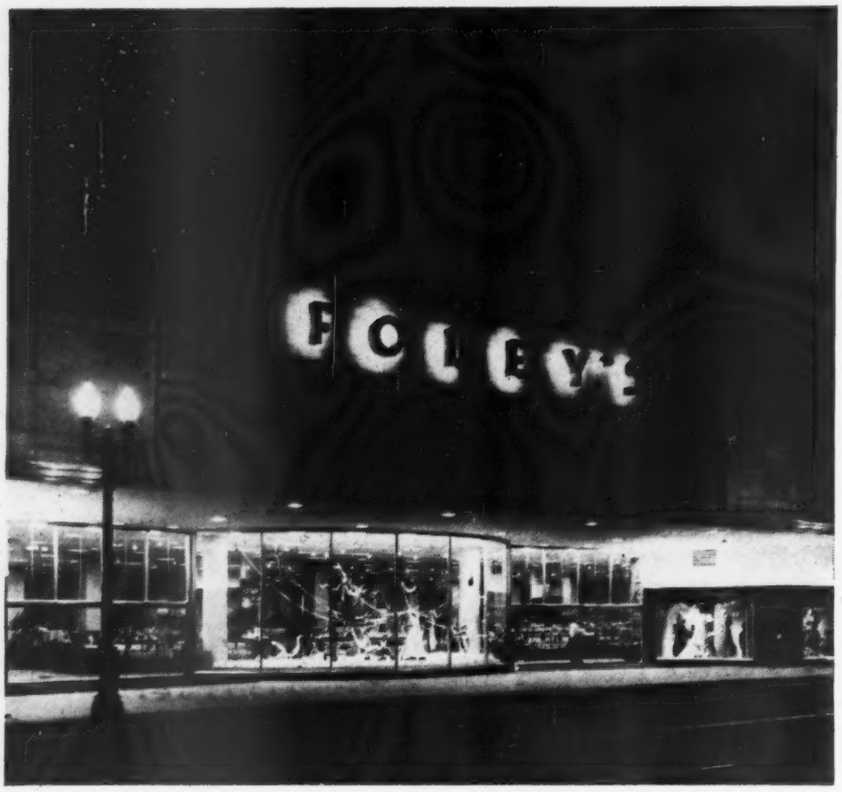
By Edward E. Ashley
Consulting Engineer
New York City

HOUSTON, Texas, holds the attention of the merchandising world. For there, catering to record first-year crowds, Foley's recently-completed $12,000,000 department store is presenting new concepts of design, service and utility for the approval of American shoppers. Radically practical in many electrical and structural details, the design of Foley's may well have definite influence on future merchandising progress.

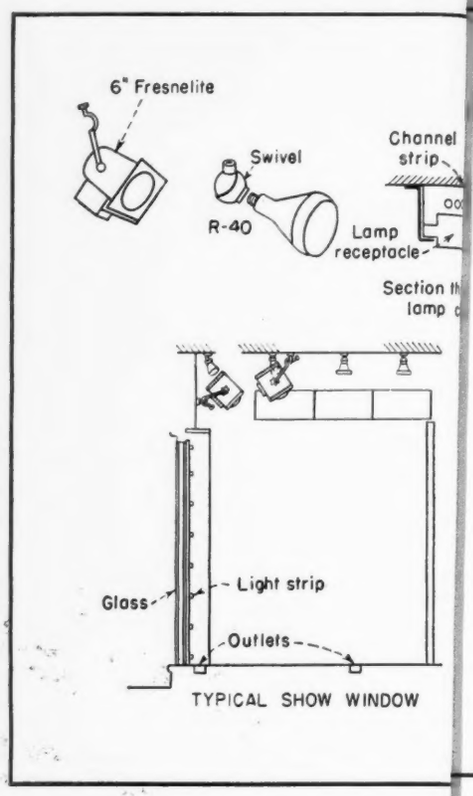
With the exception of the huge 120-foot continuous show window, the block-square store is windowless. Without windows, the store has ample space available for perimeter stock areas, giving clerks instant access to merchandise. Windowless construction also eliminates dust infiltration, it reduces heat radiation in winter, lightens the air conditioning load in summer, and permits the installation of a completely objective lighting plan.

Functional floor planning is also apparent in other sections. The toy department, located adjacent to the auditorium, can be expanded for normal Christmas demands, and a kitchen, likewise located adjacent to the auditorium, provides facilities for serving large luncheons in that area.

A vast conveyor system speeds the distribution of merchandise, spiral chutes carry purchases to a basement sorting area, and radiating motor-driven belts deliver packages to wrapping, mailing, shipping and pick-up



EXCEPTIONS to the completely windowless construction are main floor continuous show windows and Herculite glass entrances. Underside of marquee is softly illuminated by continuous cove installations above windows. Sidewalks are lighted by soft-recessed incandescent downlites.



SHOW WINDOWS are illuminated in the manner of miniature stages with spots and floods combining a variety of intensities, colors and patterns.

stations. Vertical transportation includes both escalators and elevators.

Building columns, spaced on 35-foot centers, result in the formation of expansive bays. Ceilings, furred flat throughout, contain and conceal air ducts, sprinklers, piping, wiring, recessed lighting fixtures and public address speakers.

Connected to the store by an underground pedestrian and service tunnel is a five-story semi-open ramp garage and service building. A modern warehouse, some distance from the heart of the shopping district, serves as a receiving and shipping center for truck and railroad. At present, the store contains over half a million square feet of floor area, although construction of the existing 7½-floor structure provides for the addition of five more levels. Added to this floor area is the service-garage total of 213,000 square feet and the warehouse of 120,000.

Dual Distribution

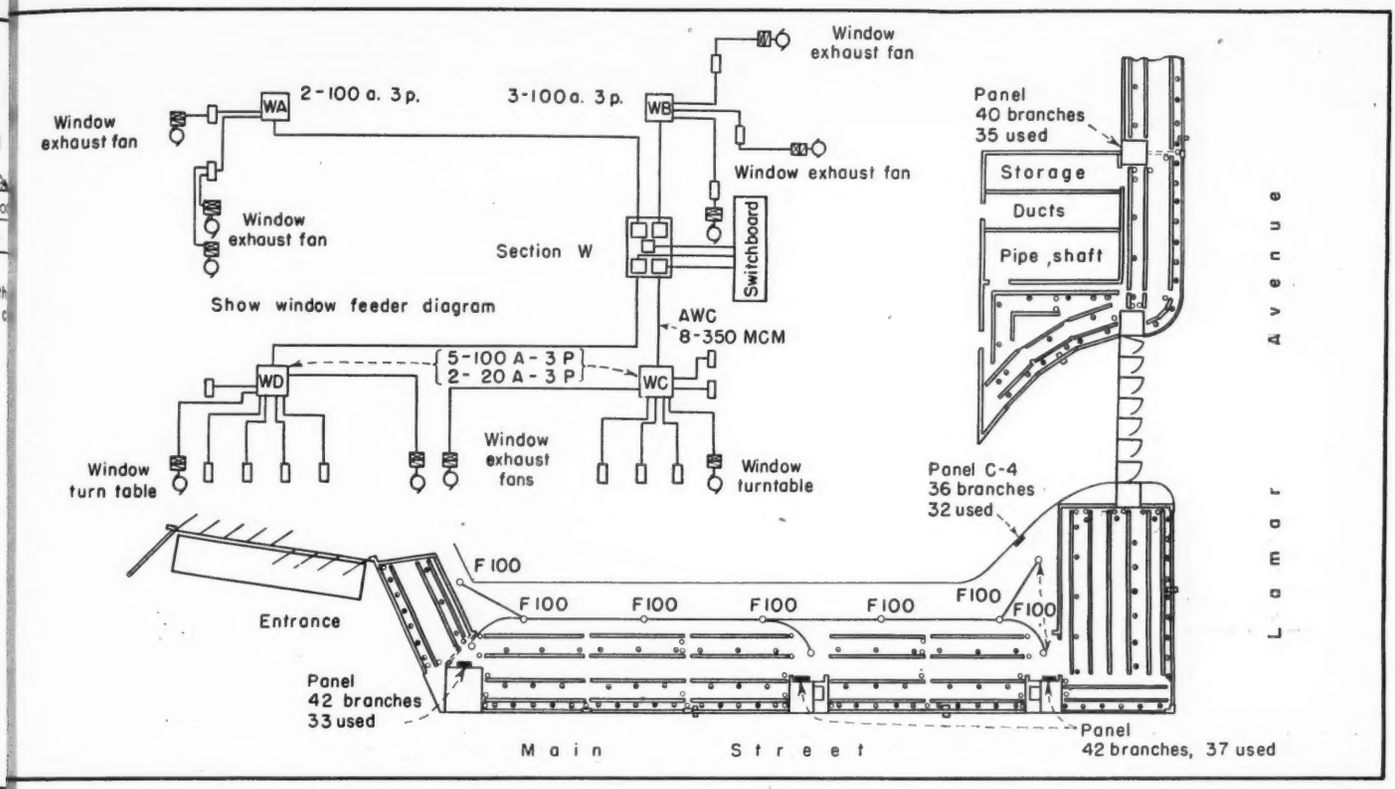
In both the store and the service-garage building, continuity of service is insured by a far-sighted utility network system installed by the Houston Lighting and Power Company, and by dual switchboards and distribution systems in the Foley buildings.

Four transformer vaults serve the Foley property and, tied together through other utility vaults in the Houston business center, they are protected by multiple high-voltage transmission feeders carrying current from separate sub-stations. Adequacy, reliability and stability of service is further insured since capacities of utility transformers are twice the expected loads. Current delivered from utility transformer vaults to main building switchboards is 208/120 volts, 3 phase, 4 wire, 60 cycle a-c.

In the store's dual system of distribution, each switchboard is divided into two sections, serving separate feeders. Alternate lights on all floors are connected to separate circuits and this same division of distribution is continued to all motors connected with vertical transportation, pumps, burners for boilers and the like.

Thus, should a major fault develop in any utility service, a section of one of the switchboards, or in internal distribution, the store still would be protected against complete outage, since 50 percent of all electrical facilities would continue to function on the half of the system not affected by faults. This dual distribution likewise makes a natural sub-division for night control of illumination, as the engineer can cut off half of the lights from the basement control center immediately after business hours. Although dual distribution systems normally are not cross connected, secondary throw-over tie feeders can establish links for emergency light and power requirements in the two buildings when required.

Switchboards are dead front, free standing, with ebony asbestos panels, and steel enclosures over switches and busses. Service switches are 3-pole enclosed air circuit breakers of 3000 and 4000 ampere ratings, constructed to interrupt 100,000-amp. short circuit currents of the utility network. Light and power feeder switches are fusible, quick-break knife switches with external operating handles. Hinged doors



Lighting, turntables and exhaust fans in show windows are serviced through a completely separate electrical distribution system. Illumination is controlled after business hours by special clocks and contactors. Lighting intensities in windows are high during the day time to combat sunlight competition.

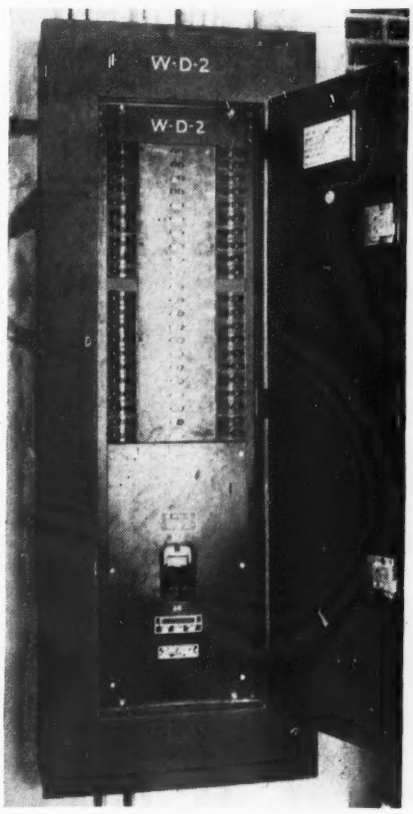
on switch cubicles provide access to fuses and are interlocked to prevent opening except when switches are open. Pull boxes extend over the entire length and width of the boards, hinged front and rear doors providing access to racked cables in the 36-inch high enclosures.

Switchboards located in the store vault control general lighting, kitchen service, show windows, signs, displays, beauty shop equipment, marquee lights, air conditioning units, escalators, passenger and service elevators, dumbwaiters, lifts, pneumatic tube blowers, fire pumps and miscellaneous power requirements. Switchgear located in the adjacent garage and service structure controls general lighting, show windows, signs, pumps for chilled water and condensate, cooling tower fans, exhaust fans, duplex sump pumps, sewage ejectors and conveyors, boiler feed, repair and maintenance equipment, electric doors and air conditioning compressors. All switchboards have spare circuits and provisions exist for adding additional switchgear cubicles as requirements develop.

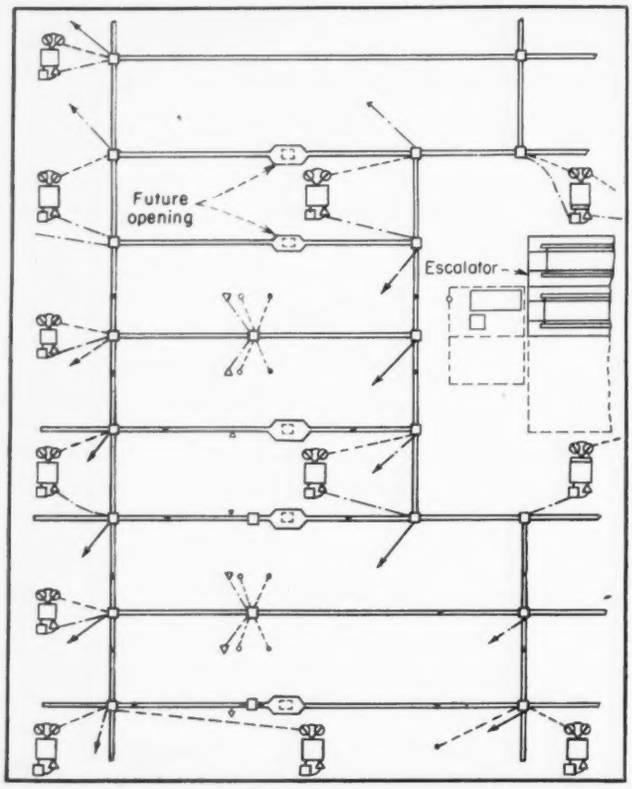
Lighting, power, and low tension distribution is distinct and completely separated, with separate conduit systems, terminal boxes and permanent markings to insure this integrity.

Wire and cable is generally single conductor, 600-volt, rubber insulated, heat resisting, type RH. The smallest wire in either building is number 12, except for control circuits less than 300 feet in length where 14 gauge is permitted. All wire and cable is factory color-coded, with separate colors for each phase and neutral, used consistently throughout the installation. In locations where unusual heat conditions are encountered, such as in the boiler rooms, impregnated asbestos and varnished cambric insulation (type AVA) is used. Wiring in basement floor slabs and in locations subjected to moisture is type RW. With the exception of splices in branch lighting circuits, all terminals, taps and splices are established with solderless pressure connectors.

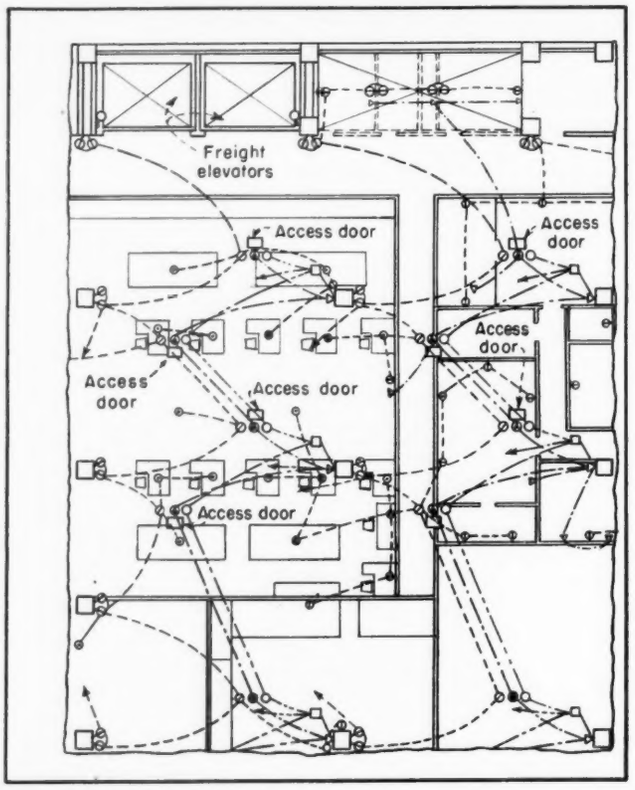
Generally speaking, all wiring is in standard weight, rigid galvanized steel conduit, although flexible galvanized



BORDER AND FOOTLIGHTS, tormenter strips, special lighting equipment on overhead pipe racks, and floor receptacles at rear of show windows are controlled from flush-mounted panels mounted on building columns.



UNDERFLOOR DUCTS are installed in basement and first floor to establish channels for wiring cash registers, displays, cases and phones. Tapping or capping of outlets is rapid.

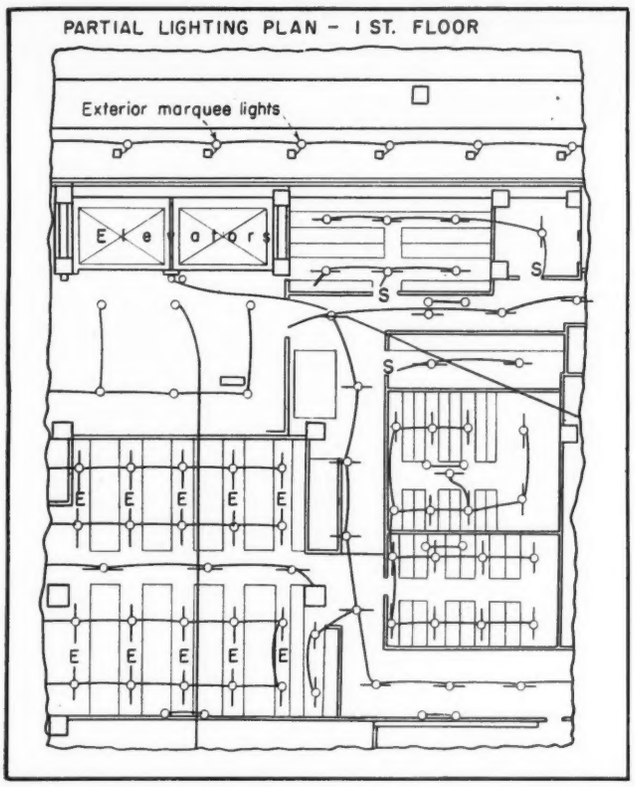


FURRED CEILINGS of upper floors are used as raceways for routing wires. Outlets for establishing floor connections are adjacent to access openings in the ceiling of each sales area bay.

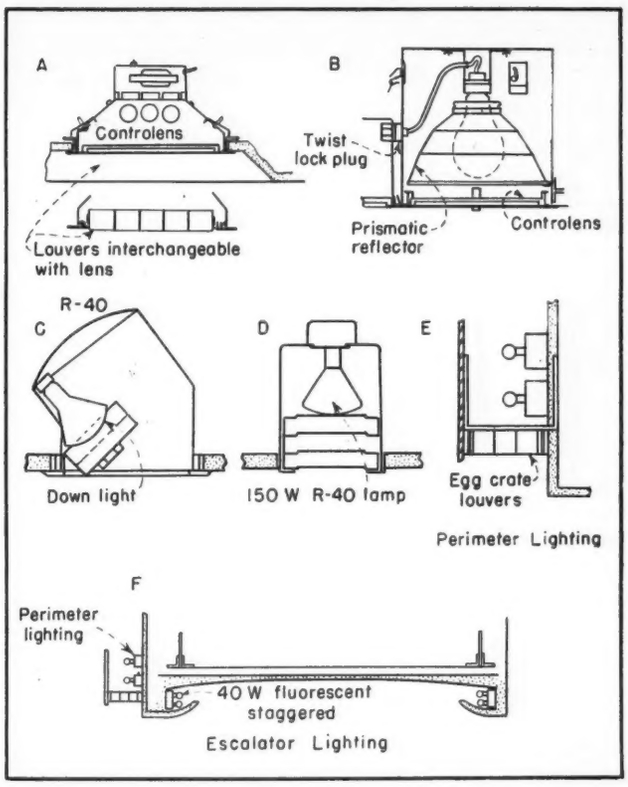
SPECIAL CEILING UNITS, combining incandescent and fluorescent lamps, have variety of housings and controls so that color, intensity and direction of light can be varied according to plan.

metallic conduit is used for short connections to belt-driven motors and in other locations where flexibility is required. Large feeders in groups are securely racked on structural supports hung directly from ceilings, and all conduits are individually clamped for security.

Distribution and control panels throughout the development are dead-front, circuit breaker types. Power panels have 208-volt, 3 phase, 3 wire main lugs, and 208-volt, 2 and 3-pole branches. Surface-mounted lighting panels have 3-phase, 4-wire, 120/208-volt mains and single phase, 2-wire, 120-volt branch circuit breakers. Lugs for all mains and branches are solderless. Lighting panels in the garage and service building are single section, while those located throughout the store are either one, two or three sections, for controlling general lighting, night lights, and lighting for floor and case depending upon location and purpose. Flush mounted panels for show windows are equipped with electrically-wound time switches and contactors. Separate panels are installed for stairways, exits, house and watchman lights. To insure continuity of service, each sales bay is served by at least two independent circuits obtaining service from separate vaults.



LIGHTING PANELS throughout store are 1, 2 or 3-section, for controlling general lighting, night lights, and lighting for floor and showcases. Alternate lights are on separate circuits.



PRIMARY LIGHTING UNITS are recessed above ceilings with sides of plaster openings splayed to conform with light spread. Special treatments are used for high-lighting special displays.

A recently developed system of distribution, designed to provide facilities for floor outlets, employs the space of the entire furred ceiling below the floor as the raceway for routing wires. In this system, which is used generally on all of the upper floors, installational flexibility is obtained for 120 volt, telephone, or signal system outlets. Access into the ceiling is provided at six locations in each bay of the selling areas through readily removable special in-built lighting units equipped with plug-in connectors and suspension chains to facilitate ready access. Concealed in the furred ceiling adjacent to each access, wiring outlets are located which connect to the distribution system of the floor above. A newly developed cast iron floor outlet, inserted at any point in the floor and connected to the blank outlets below, minimizes the difficulty of establishing connections.

This system of distribution, for serving floor outlet requirements, permitted the utilization of a unique construction feature in the upper floors of the building where floor finishes, such as linoleum, asphalt tile and carpeting, are applied directly to the tops of arches of the concrete joist construction, without any fill being employed. This reduced building construction

COMBINATION CLOCK, executive paging panels and signals are located above escalator canopies. Paging numbers appear when associated lights behind laminated plastic indicator plates are illuminated.

costs, due to the omission of fill and cement finishes, with a resultant lessening of dead loads on framing, columns and footings. It also added to the ease of establishing the electrical floor connections. This follows a popular trend for serving the ever increasing needs for flexibility of the selling areas, a need which has taxed the ingenuity of architects, engineers and manufacturers for many years.

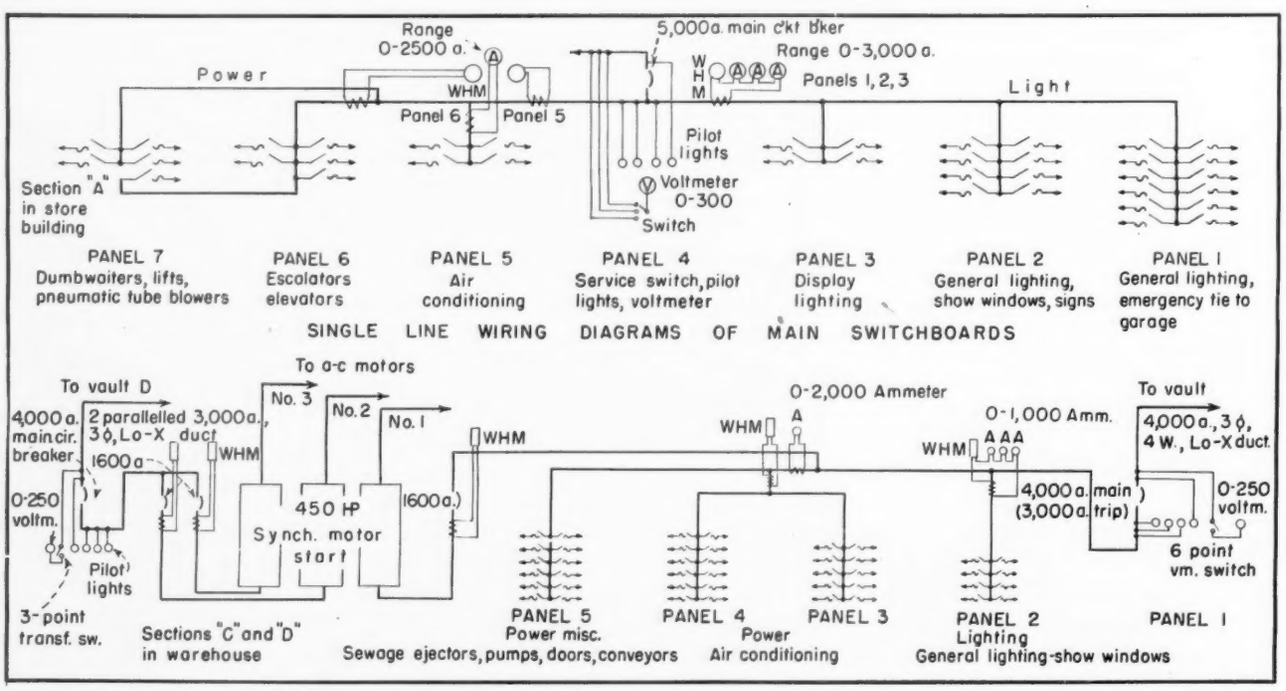
To maintain flexibility for serving cash registers, displays, show cases, telephones and credit authorization phones in the basement and on the first floor, where ceiling access was not practical, an underfloor duct system is installed. Double rows of sherardized ducts, equipped with precast inserts on 2-foot centers, establish wiring networks in these areas. They are an integral part of the floor construction and can be tapped for service at any point. Conversely, capping outlets which are no longer needed and restoring floor surfacing is a simple operation. Ducts have large capacities and the number of wires carried can be increased as new requirements dictate.

To eliminate outages in the lighting system due to the necessity of changing show case, wall case and cash register outlets, wiring to all floors, wall and column outlets are connected on separate systems of circuits, feeders and switchboard control. In this manner, floor circuits can be cut from service without affecting overhead lighting.

In addition to distribution provisions for power and lighting, separate conduit systems are installed for fire alarms, key stations on watchman compulsory-tour routes, sprinkler annunciators, time clocks, signal systems (including dismissal bells, executive calls and photo-electric eyes for guarding first-floor exits), high and low water alarms, authorization telephones, public telephones, telegraph, motor pilots and remote control panels. An additional conduit system, empty at present, is designed for future television, radio broadcast or intra-store utilization.

To minimize faulty operation, all motorized equipment, except elevators, escalators and cooling towers, are started locally at the motor with start-stop pushbuttons activating magnetic starters. A motor pilot light and remote-stop control panel, however, is located in the engineer's office in the service building, indicating the operation of all fans, pumps, compressors and other motorized equipment in the store. For the cooling tower fans, located on the roof, start-stop remote control pushbuttons are installed between rows of corresponding high-low speed pilot lights on the control board. All other motors have stop pushbutton stations only beneath their pilot lights. Relays, pilot lights and remote control pushbutton stations are so wired that lights and corresponding motors operate simultaneously, pushbuttons permit remote stopping of any motor individually.

Conveyor systems are a vital link in Foley's facilities for receiving, marking, stocking and distributing merchandise. The flow of goods into the store begins at the company's 120,000-square-foot warehouse located approximately 3½ miles from the store. Railroad sidings, work rooms and fur storage facilities are attributes of this structure. Loading and shifting of merchandise is aided through the utilization of motorized industrial fork-lift trucks. Delivery trucks speed goods to the midtown garage service building where it is unloaded and carried underground by electrically operated conveyor belts from garage loading platforms to receiving and marking rooms in the store basement. After buyers check goods and mark them for price,



DUAL DISTRIBUTION begins with multiple utility vaults and continues through the store and service building. Should a fault develop in any service, a section of one of the switchboards, or in internal distribution, at least 50 percent of all facilities would remain in operation. Dual systems supply both power and light, providing positive insurance against complete outage.

merchandise is placed on wheeler trucks that fit exactly into service elevators. Elevators, controlled from the basement, automatically rise, stop and unload at the proper floor. Placing merchandise in perimeter stockrooms or on display, therefore, is a comparatively minor and rapid operation.

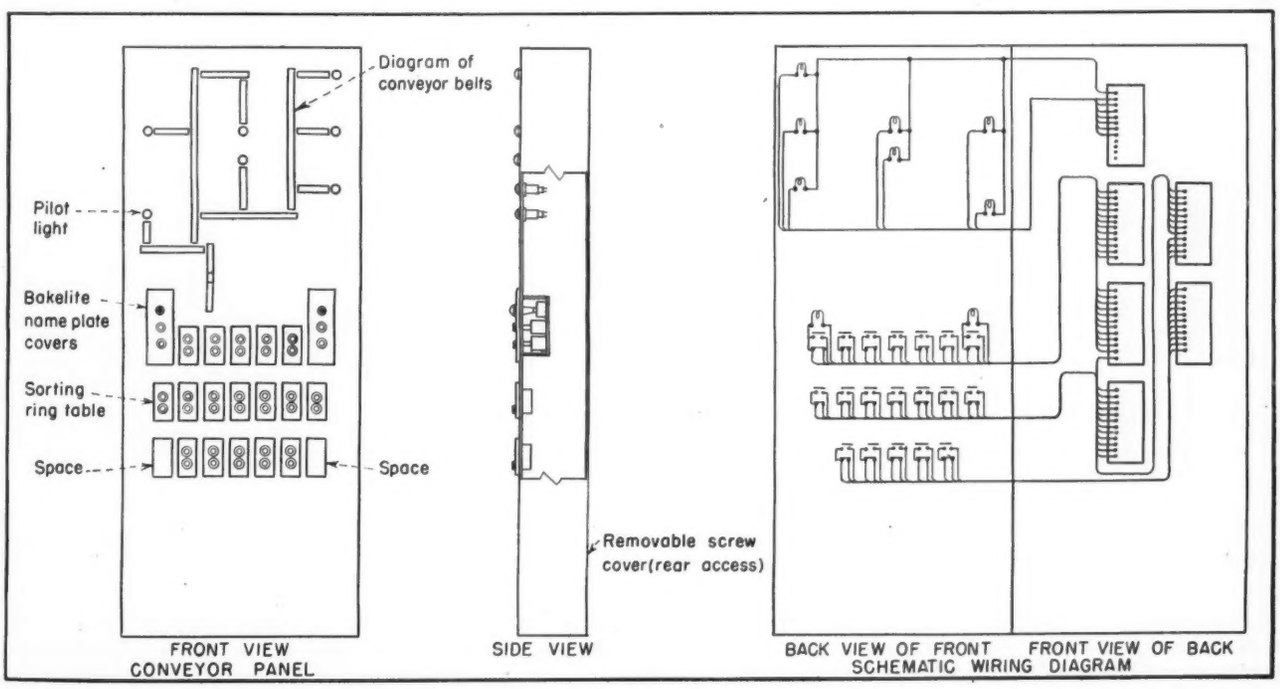
After merchandise has been purchased, it is initially wrapped and dropped down spiral chutes to conveyor belts running to a central sorting ring. Here the packages are manually placed on radiating conveyor lines running to various departments for additional wrapping, mailing, general delivery by truck, or customer pick-up. Where customers have motored to town and have parked their cars in the store's garage, their license numbers are recorded on their packages by the sales clerks, garage attendants lift these packages from the basement conveyor belts, and packages are immediately placed in customers' cars.

The need for proper illumination needs little emphasis for, in a windowless building such as Foley's, the lighting system has a tremendous bearing on the psychology of selling. It definitely influences environment and contributes greatly to the cheerfulness and attractiveness of the surroundings.

To achieve general diffusion as well as to emphasize displays, the lighting plan employs both incandescent and fluorescent sources. Glare and eye fatigue are minimized, and color balance is obtained by blending the incandescent predominance of reds and yellows with the blue-green-violet qualities of fluorescent lighting. Color was also considered when selecting materials for walls, ceilings, columns and floors. For example, pale pink Tennessee marble was selected to cover the first floor so that reflected light would add warmth to the coolness of the overhead fluorescent lighting.

For special free-standing or show case displays, for decorative effects, and for concentrated intensities in some areas, lighting includes fluorescent coves, recessed incandescent downlights and directional spots. Yet lighting is fairly standard throughout most of the selling, administrative and special areas.

The typical lighting fixtures were constructed by Day-Brite Lighting who faithfully interpreted on their production line the special fixture designed for Foley's. The fixture consists of two 4-foot 3-lamp fluorescent units and two incandescent assemblies. The four fixtures are mounted in line with incandescent assemblies at either end. Units are recessed several inches above normal ceiling lines, and ceilings are splayed so that sides of the beveled recesses coincide with the spread of emitted light. Incandescent fixtures are provided with a combination of housings, reflectors and lens, so that, by using various accessories, lighting may be diffuse or concentrated in a vertical or oblique beam. Lens are mounted in drop-hinged frames so that relamping can be completed without removing lens completely from fixtures, and optical assemblies are connected to wiring circuits through twist-lock receptacles for rapid interchange of complete assemblies. Adjustable sockets in the incandescent sections permit the use of 100, 150, 200 or 300-watt lamps, and each 4-foot fluorescent section is wired to permit 1, 2 or 3 lamps to operate, thereby permitting extreme flexibility in varying illumination intensities. Throughout the building, typical fixtures are equipped with glass lens panels. Wiring and switching of units permits variations in both intensity and color quality, since the number of fluorescent lamps used in each fixture can be controlled, and incandescent and fluorescent fixtures can be used separately or conjunctionally.



OPERATION OF CONVEYOR SYSTEM is controlled from motor-pilot-light and remote-control panel. Indicating lamps mark moving belts. Conveyors carry merchandise from loading platforms to marking and sales areas. They also deliver goods from upper floors to sorting ring and thence to wrapping, mailing or pick-up centers.

Without cutting or patching finished ceilings, it is possible to vary lighting intensities from 7 to 40 footcandles.

Before entering the store, patrons are impressed by the lighting in the 120-foot continuous show window, by the indirectly-illuminated marquee which completely surrounds the building, and by special electrical displays mounted on the building exterior.

Except for illustrations carried in advertisements, show windows are the first important medium for presenting merchandise to the public. The show window that best serves its purpose is constructed as a miniature stage. This thesis is emphasized at Foley's.

Show windows are serviced through a separate electrical distribution system which supplies current for lighting, exhaust fans and turn tables. Pipe racks, lamp receptacle strips and numerous service outlets permit the use of spot and floodlights in any desired combination of color, intensities or positions. Tormenter strips are installed on inner faces of all pilasters and provisions exist for installing footlights when required. Four rows of 150-watt R-40 lamps on 6-inch to 12-inch centers, with alternate outlets on separate circuits, traverse the ceiling shielded by baffles. Pipe racks provide support for heavy fresnelites and convenience outlets on 4-foot centers are floor-recessed along the rear of each window for special equipment. Movable background panels can be used to confine pedestrian attention to window displays, or they can be removed to permit uninterrupted inspection of the entire first floor interior.

To overcome daylight competition, windows carry between 150- and 200-footcandles of intensity with additional emphasis on special displays. At night, to avoid glare, lighting is reduced by alternate circuit control.

Marquee Illumination

Above the exterior window lines, continuous cove lighting illuminates the underside of the marquee. Sidewalks are lighted by marquee-recessed incandescent fixtures having prismatic lens for wide light distribution.

On the face of the building, stainless steel 4-pole weatherproof outlets are set flush with the stone facing and, for holidays or special events, electrical displays can be mounted on the surfaces of the building and connected through these outlets. Outlets are wired on vertical risers and are controlled from first-floor lighting panels.

Audio Facilities

Complete audio facilities, engineered by Langevin, serve the entire store and the semi-open garage. The system is adaptable for the use of built-in AM-FM radio tuners, transcription turntable, wired music service, paging and announcing microphones. It enables the store to broadcast important radio programs, provide music for shoppers, present planned record programs, or make special announcements to customers. In addition to store-wide broadcasts, separate public-address facilities are installed for discussing fashion shows in the salon area, presenting special programs in the auditorium, and paging customers' cars in the garage. With loudspeakers located scientifically throughout the store, loud and soft areas are eliminated and low-level broadcasts can be distinctly and uniformly distributed. Speakers are inconspicuously mounted in sales areas, since they are installed flush with ceilings behind louvred egg-crate grills. In non-selling areas speakers are round, shallow, surface-mounted units.

Executive paging and signal bells are combined in special clock housings. Attractive housings are trimmed with bronze, clock dials are of black bakelite, while hands and hour markers are polished bronze. Flanking the clock faces are vertical visual-paging annunciators having white fronts, black backs and laminated plastic indicator plates so that numbers appear on the white exterior surfaces only when the associated lamps are lighted. The main paging selector keyboard, in three sections, has a capacity for 120 calls. Bell calls emanate from grills in the bases of the units.

Maximum efficiency of telephone service is obtained by the employment of an automatic intercommunication system, permitting all internal calls to be made directly by dial instead of going through the switchboard. This materially lessens traffic through the switchboard and reduces the number of operators required. Telephones in selling and service areas can be controlled so that no outside calls can be made through these instruments, thus minimizing personal incoming and outgoing calls.

Vertical transportation is an important item, planned for maximum service not only during normal shopping periods but also during holiday peaks. Moving stairways, centrally located in the geographical center of the selling areas, are prominently featured by special canopy lighting treatments, and they are readily accessible from all floors. Oversized to permit two passengers to comfortably occupy each tread, the escalators have a capacity of 7200 persons an hour and can carry to upper floors 70 percent of all incoming shoppers at any peak period. While this safely exceeds anticipated demands, elevators augment this service and are accessible to the street through a special entrance.

Expected utilization of vertical transportation was scientifically estimated in accordance with country-wide surveys which indicated that approximately 20 percent of the shoppers would enter the store in a single peak hour at lunch time each day, with Christmas traffic double that of a normal good day, and Easter crowds about 80 percent of the Christmas peaks. Transportation facilities were planned to carry these peaks to adequately serve the buying and shopping public.

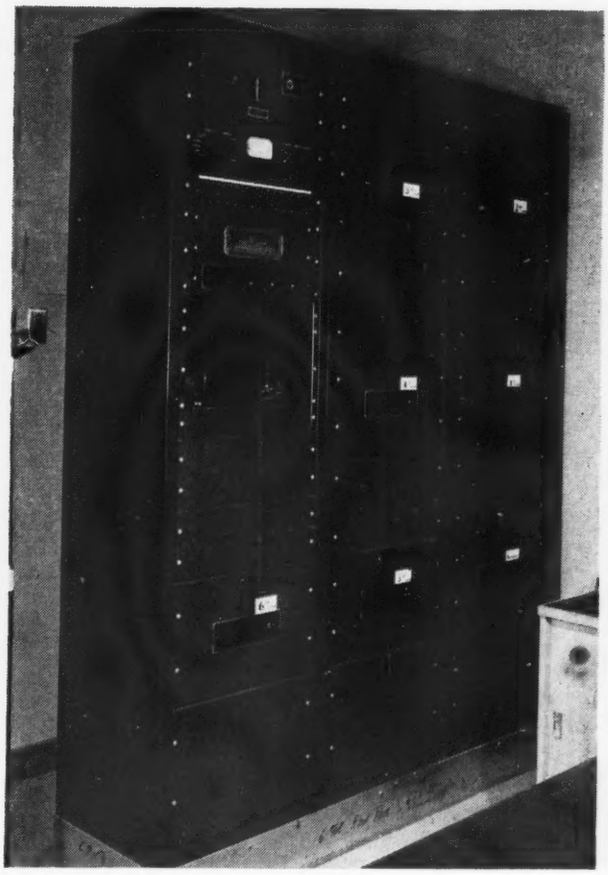
Air Conditioning

Year round air conditioning controls temperature and humidity throughout the store. Electrostatic filters, purifying initially-clean air which comes across the Gulf waters and the surrounding sandy soil, achieve near-perfect results in ridding air of dust. Since windowless construction prevents the entrance of all except filtered air, soiled merchandise and maintenance is reduced to a minimum. For maximum economy, outside air is used for heating or cooling the store whenever climatic conditions warrant. Economy is also achieved by the use of radiant heating around the perimeter of the building which offsets wall heat losses during winter months.

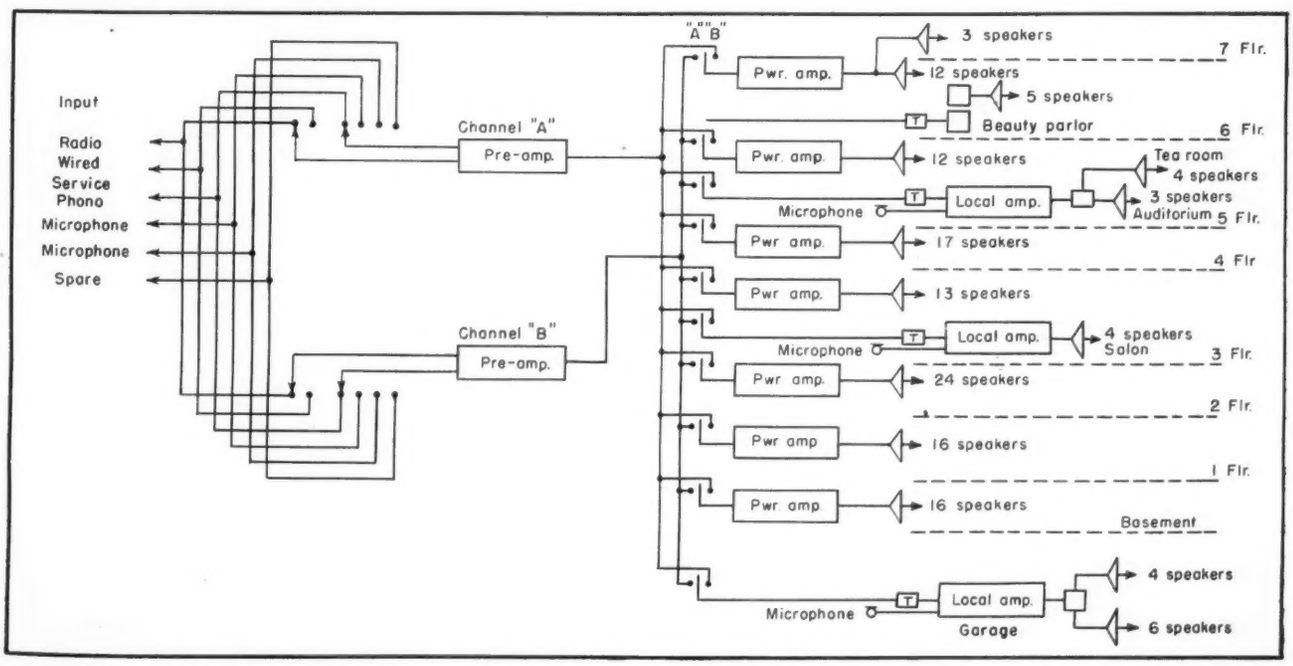
Serving in the capacity of consulting engineer for all electrical and mechanical installations, our organization worked closely with Fred Lazarus, Jr., president of Foley's parent company, Federated Department Stores; Kenneth Franzheim, architect; Fisk Electric Company, electrical contractors, and Raymond Loewy Associates, retail planners and designers.

. . . Foley's of Houston

LOUDSPEAKERS are located scientifically throughout store so that broadcasts can be plainly heard in all areas although low in volume. Speakers are recessed behind ceiling grilles.



AUDIO FACILITIES were engineered by Langevin. Central panel controls selection of program, volume and areas where broadcasts will be heard.



COMPLETE AUDIO FACILITIES include provisions for built-in AM-FM radio tuners, transcription turntables, wired music service, paging and announcing microphones. Entire store and semi-open garage is served.

IN ADDITION to store-wide broadcasts, separate public-address facilities are installed to permit the discussion of fashion shows in the salon area, the production of special programs in the auditorium, or the paging of cars.

BANK SIGNALS and ALARM SYSTEMS

FIG. 1—Typical sound detector reacts to predetermined noise levels.

By A. A. Schuhler

Specialized signals and communication contribute to security, efficiency and effective administration in banking institutions. This article describes modern bank signal methods and equipment.

THE dominant element in the financial welfare of a community are its banking institutions, of which there is demanded more than from any other form of economic or industrial institution, the essential quality of unquestionable financial security.

Confidence in the ability of a bank management to adequately handle transactions and protect funds, is of course, eventually established by continued successful operation. However, to more readily secure from the public that universal approval which so largely governs expansion possibilities, bank designers and architects have long recognized the inestimable value of interior decorations and equipment significant of quiet dignity and rugged strength, yet rich and pleasing in appearance.

In line with this thought, steps are taken to protect the repositories with delicate and costly time-lock mechanisms and sensitive electrical protective circuits to insure the absolute safety of the contents during periods when the personnel of the bank is not present. However, dangers of equal magnitude exist when the full working force is present. Therefore, an equally impregnable daylight system should be operative.

In the larger banks, there is required a quiet, efficient method of communicating instructions or information from one part of the organization to another. The advantages of quietness and secrecy cannot be overestimated under many of the conditions which are bound to exist.

Three Safety Systems

Generally there are three types of systems used in banks. First, the protective, second, the personnel, third, the clients. The systems used for protection are the vault alarm, safe alarm, file alarm, premises alarm, hold-up alarm, emergency alarm and guard call, watchman's report and fire alarm. The systems used by the personnel are the annunciator call, teller's call, staff In and Out, paging, intercommunicating telephone and clocks. The systems used by the clients are the coupon booth and door bells.

Vault alarms provide protection for the entire repository, and various methods are followed in securing the final result. Time locks are furnished on the doors of the vaults and arranged to operate an alarm if opened at any other but a predetermined or scheduled time. Heat detectors are provided on the doors to transmit an alarm if a torch should be applied. Sound detectors are installed within the enclosure which will pick up any predetermined volume of sound. The walls, floors and ceilings of the enclosure may be laced with cable and especially circuited so that an alarm will be transmitted if the cable is broken during an attempt to drill or break through. All wiring for such systems are controlled and electrically supervised and tested through a control panel. The alarms may be sent to a central point within the building, to the police department or to an exterior central station. A typical sound detector is shown in Figure 1.

Safe alarms provide protection for smaller safes which may be distributed at different points throughout the premises. These may be protected by means of wood cabinets, which totally enclose same and are furnished with a door. They are arranged with contacts and are wired with conductors or lined with foil strips. Safes may also be protected with capacity alarms so arranged that a signal will be transmitted when a person comes within a predetermined distance of same.

File cases may be protected in the same manner as for safes described above. Where a large number of files are to be protected, the entire room in which they are located may be thoroughly equipped to prevent intrusion from the outside, such as windows, doors, ceilings and floors. The windows should be foiled so that any part of the glass which may be broken will also break the foil stripping. Doors may be equipped with contacts and panelled with foil or wired screening. Floors may be protected by wired

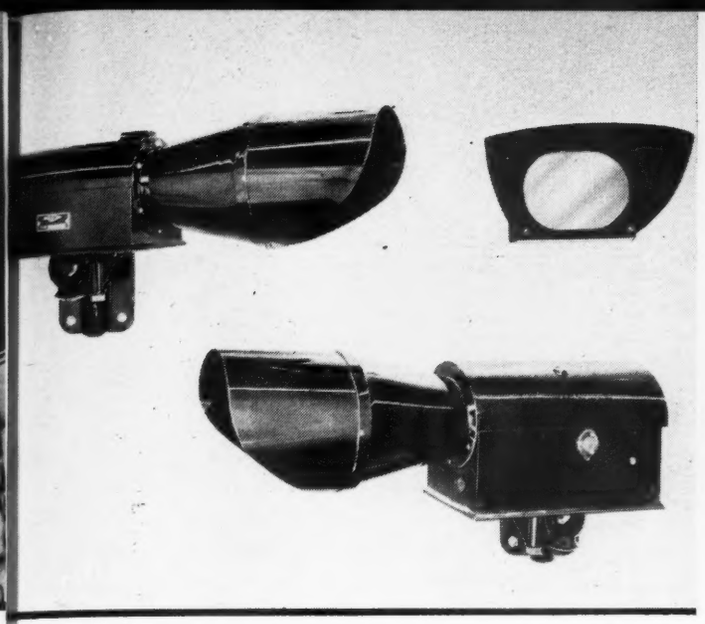


FIG. 2—Elements of photocell systems are light, mirror, and photo relay.

FIG. 3—Foil strips on windows break with glass to actuate alarms.

screening, however, this requires that another floor be built over the existing floor since the screening is placed between the two. Photoelectric systems may also be used to protect the floor areas.

Premise alarms consist of photoelectric ray equipment arranged so that the invisible beams are directed to various points, and at different levels. The chief equipment consists of a light source and a photoelectric receiver. However, the beams may be reflected over a wide area by means of adjustable mirrors. Breaking the beams at any point causes the relay in the receiver to actuate so that its contacts will operate the alarm circuit. The chief elements of a photoelectric system are shown in Figure 2. Windows and doors may also be protected to introduce the delay element which is so vital in the apphension of intruders. The method of protecting windows with foil is shown in Figure 3.

Hold-up alarms in their simplest form usually consist of foot-rail switches, pushbuttons, bells, horns, sirens and a control panel. Foot-rail switches are located on the floor of the clerk and tellers booths, and are operated by the feet. Pushbuttons are mounted in a concealed portion of the counter, desks and tables and special contacts are placed in the cash drawers and are all operated by the hands. A small bell may be installed in the interior of the building near some supervisory location. However, a large bell, horn or siren may be mounted on the exterior of the building so that the alarm may readily be heard. A control panel permits a small supervisory current to pass through the equipment and the wiring at all times so as to detect any possible trouble in the system, and to operate a disarrangement signal under such circumstances. An extension signal may be added to transmit an alarm to a nearby police station should this be desired.

Emergency and guard calls are used in larger banking institutions where many departments are distributed on different floors. The circuits are laid out to provide for two types of signals. One of these is used for calling the guards and is quiet in operation, the registrations being made on lamp annunciators and other lamp signals. Where desired a subdued buzzer may be included. The other circuit is the emergency alarm which when operated sounds alarm gongs throughout the building at any desired location, and at the same time operates the lamp annunciator and location lamp signals on the guard's call.

The emergency alarm system is protected by electrical supervision throughout all contacts and circuit operating equipment. Each of the systems consists of one or more circuits, each one taking care of a certain area termed a zone. The particular zone from which any alarm may originate is indicated in two ways; (1)

(Continued on page 152)

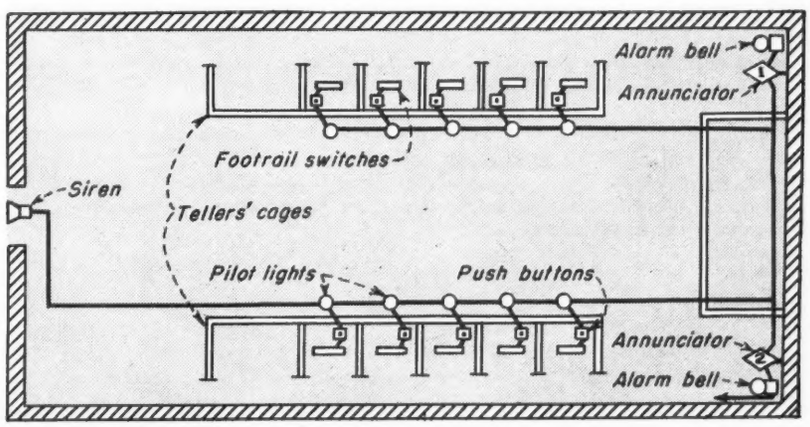


FIG. 4—Typical emergency alarm layout using lamp signals, annunciator and audible signals.

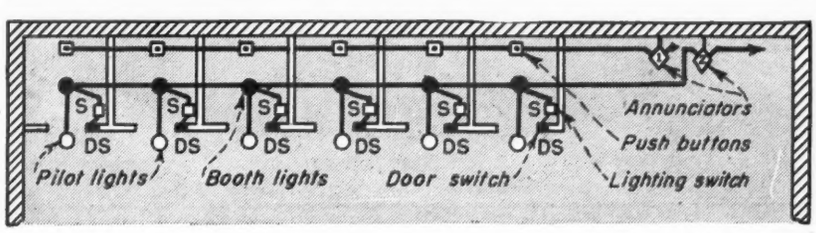
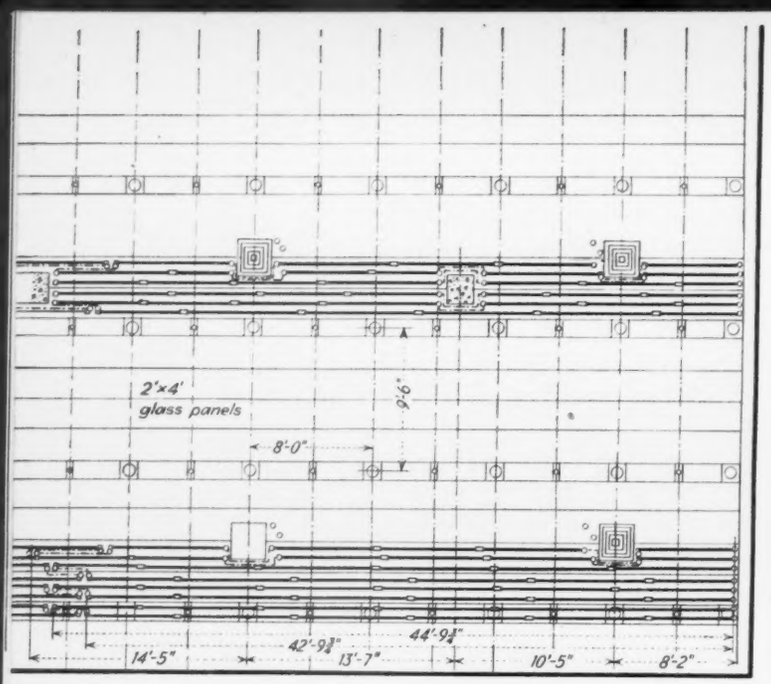
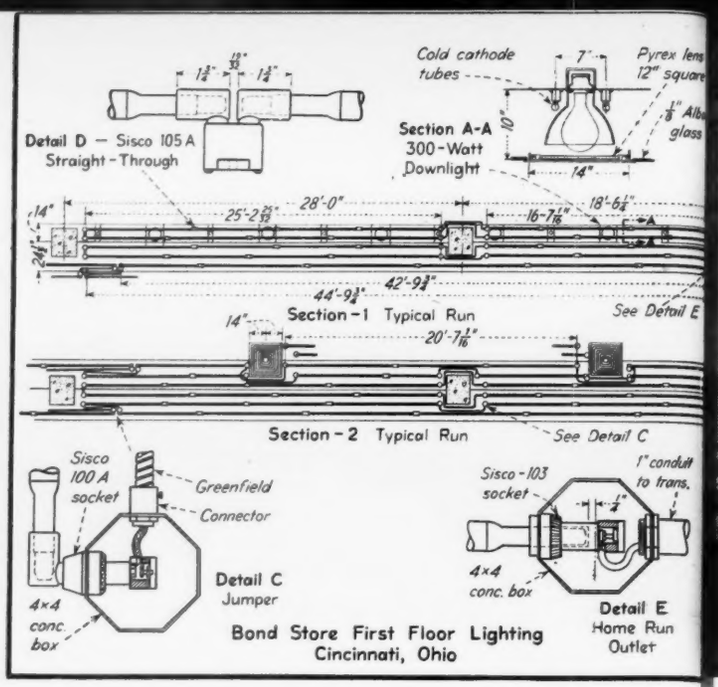


FIG. 5—Coupon booth signals indicate occupancy and provide for attendant call.



PLAIN VIEW of luminous ceiling showing spacing and location of cold cathode tubes and incandescent downlights.

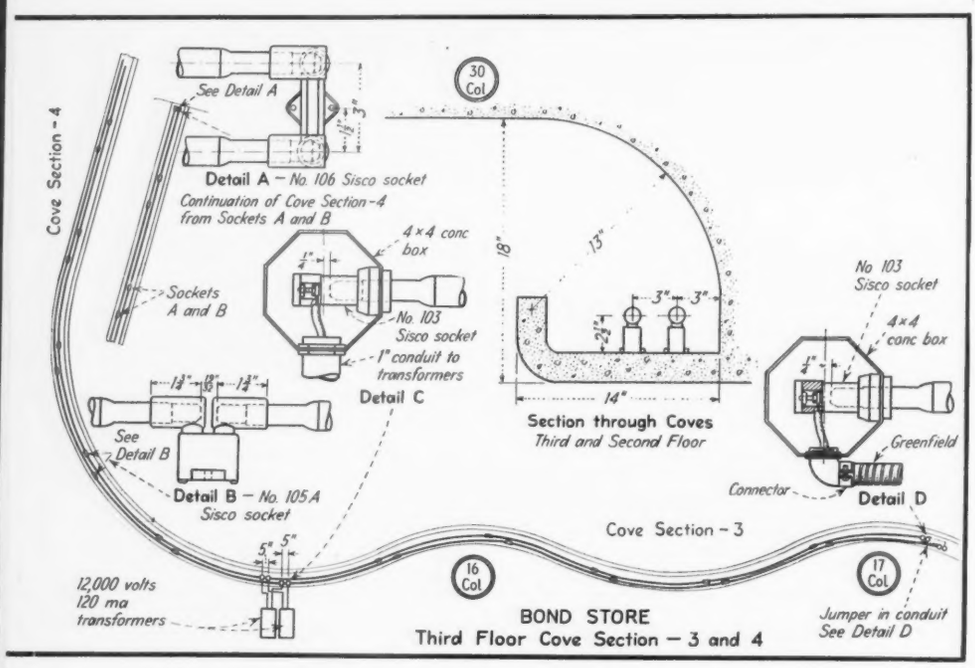


DETAIL of cold cathode ceiling installation showing wiring methods used for jumpers and circuit connections.

LIGHTING

AT BOND'S ULTRA-MODERN STORE

Air-cooled luminous glass ceiling, soft border coves and concealed downlights characterize lighting treatment at Bond's new Cincinnati store.



DETAILS of typical cove construction and methods of connecting lamps to high-voltage circuits.

Arthur E Bertke
Bertke Electric Co.
Cincinnati, Ohio

A NEW HIGH in store lighting technique was established when Bond Clothes, Inc., opened its new store in the Terrace Plaza Hotel Building—ultra-modern structure being built in Cincinnati's business center. The store occupies five floors in one corner of the building. All but the main floor sales area are windowless.

Through the two-story plate glass exterior (two sides) of the store, many Cincinnatians had their first glimpse of an all-glass luminous ceiling in the main floor sales area. Those who ventured on the other three windowless floors saw skillful combinations of decorative and functional lighting blending with the modern interior designs.

Most unique from a design and in-

INTERIOR VIEW of main floor showing glass ceiling panels with flush incandescent downlights, air conditioning outlets and sprinkler heads.

SOFT COVE LIGHTING, fluorescent recessed units and incandescent spots provide functional and decorative illumination on other sales floors.

EXTERIOR NIGHT VIEW of Bond Store showing luminous ceiling and two-story glass show-windows

stallation viewpoint, and most attractive to passers-by, is the luminous glass ceiling of the main floor. More than 100 kilowatts of energy are consumed by the lighting units concealed in the 90-ft. by 70-ft. ceiling. Approximately 70 percent of this is used by 100 continuous rows of cold cathode tubes mounted on 8-inch centers to the ceiling slab. One hundred circuits, each served by a 12,000 volt transformer, operate the tubes at 60 milliamperes.

The remainder of the ceiling wattage is consumed by 96 incandescent downlights (300 and 500-watt) mounted flush in the ceiling on 8-ft. by 9-ft., 6-in. centers. The Bond pink cold cathode tubes (a special color blend between 3500° K and soft white developed by General Luminescent Corp., Chicago) give a soft glow to the glass ceiling; the incandescent spots produce the "punch" light on the merchandise some 16 feet below.

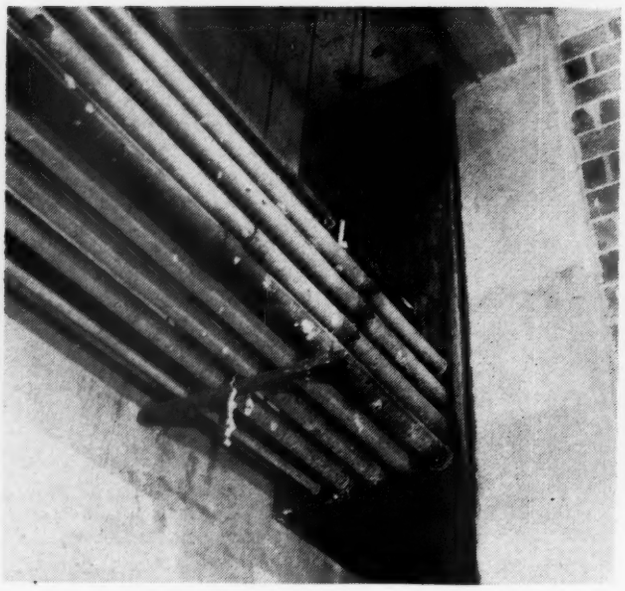
The glass ceiling, suspended 10 inches below the ceiling slab, conceals all tubes, wiring and downlight assemblies. It consists of numerous 4-ft. by 2-ft. ALBA No. 66 ribbed glass panels resting on an aluminum grid made of inverted-T sections. Strip felt gaskets cushion the panels on the metal frame. Downlights are enclosed by 12-inch square Pyrex lenses. Both lighting systems combine to produce approximately 50 footcandles on the main floor.

To gain access to a lamp tube or socket, the maintenance electrician merely pushes up and slides back one of the glass ceiling panels. The four-foot length provides ample room for socket or lamp replacement. According to the cold cathode lamp manufacturer, these 60 ma. tubes will have a life of about 15,000 hours.

Supplementary display lighting and niche spots highlight special merchandise displays. Street display window lighting is provided by a continuous band of double-row fixed incandescent spots with a single adjustable unit every five feet.

Twenty-one conduit feeders (2½ and 3-inch), originating at the hotel main switchboard in the sub-basement, supply the store area with 120/208-volt 3-phase, 4-wire power. A total of 22 lighting and four power panels are served by this feeder group.

GLASS PANELS of luminous ceiling rest on aluminum inverted-T frame; can be raised and slid back to provide access to cold cathode sockets and tubes.



BOND FEEDER GROUP (21 conduits) leave hotel sub-basement switchboard and go underground to riser location. Shift from steel conduit to fibre duct occurs at pull box.

Unique wiring methods were required for the luminous ceiling installation. To eliminate dark streaks, cold cathode socket locations were staggered. This required the use of four different tube lengths (from 3 ft. 9 in. to 7 ft. 9 in). Jumpers were used to connect continuous rows of tubes at column and air-conditioning outlet locations; also to connect adjacent rows at the center of the ceiling where continuous runs were split for circuiting arrangement. At each jumper, 4-inch octagon outlet boxes with a flexible conduit tie were installed. Straight (SISCO No. 103) or right angle (SISCO No. 100A) cold cathode sockets were mounted to one side of the outlet; the flexible conduit jumper to the other. A similar scheme was used at the end of tube runs where the home run conduits (one high-tension cable per conduit) went to the lighting panels, also on cove lighting for other sales floors. Each 12,000-volt cold cathode series circuit involves approximately 90 feet of tubing.

The 100 transformers (12,000-volt) serving the luminous ceiling cold cathode lighting are housed in ten separate cabinets located in easily accessible closets and stock room spaces. Each cabinet contains a group of ten units and is connected to the ventilating duct to assure ample cooling facilities. Adjacent to the transformer cabinet is the lighting distribution cabinet controlling individual cold cathode circuits.

To reduce the shock and fire hazards of the 12,000-volt cold cathode system to a negligible point, and eliminate possible damage to transformers and circuit wiring by overvoltages, a McDermott Model P-4 protector relay was installed in each transformer circuit. This protector at all times supervises the flow of current from the transformer secondary into the ground. Should this current exceed a safe value for human contact, the primary circuit is opened and remains open. It can be re-energized again only by cutting off the power to the circuit and putting it on again. It will immediately reopen if the fault has not been cleared when the circuit is re-energized. A gap arrangement, connected between one side of the transformer secondary and ground, provides protection against overvoltage resulting from an exhausted, broken, or removed lamp tube.

The protector immediately cuts off the power to the circuit if any of the following should occur:

1. A person touches a dangerously live part.
2. A tube flickers or is removed from its socket.
3. A transformer is overloaded or has defective tubes in its circuit.
4. A ground develops in the high-voltage wiring.

Each transformer is mounted in a separate metal enclosure with access door. Rubber mounting insulates the transformer from the enclosure and contributes to noise suppression. As an added safety precaution, each enclosure is equipped with a switch that disconnects the transformer primary when the enclosure door is opened.

Ceiling is Air Cooled

Another unusual feature of the luminous ceiling installation is the electrical interlock between the lighting feeders and the store air-conditioning system. The ten-inch space between the glass ceiling and the concrete slab is part of the air-conditioning system which, because of the windowless construction, operates all year. Thus, ample cool air is assured at all times to dissipate any heat generated by the lighting units in the ceiling.

Engineering Personnel

OWNER—Thomas Emery's Sons, Inc., Cincinnati, Ohio

LEASEE—Bond Clothes, Inc., Rochester, N. Y.

ARCHITECTS (Building)—Skidmore, Owings & Merrill, New York, N. Y. (Store Interior) Minneapolis, New York, N. Y.

BUILDER—Frank Messer & Sons, Inc., Cincinnati, Ohio

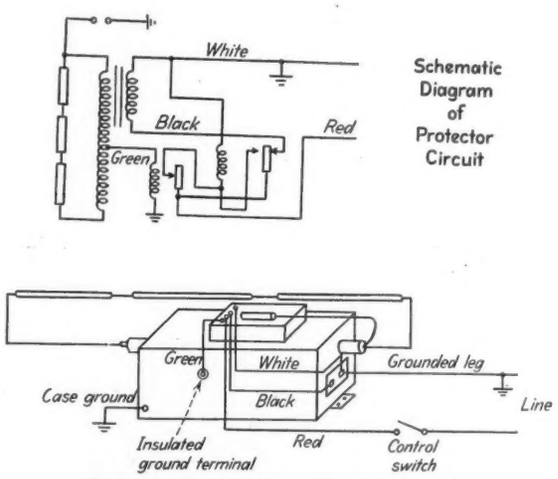
CONSULTING ENGINEER—Guy B. Panero, Successor to Clyde R. Place, New York, N. Y.

LIGHTING ENGINEER—A. Feder, Lighting by Feder, New York, N. Y.

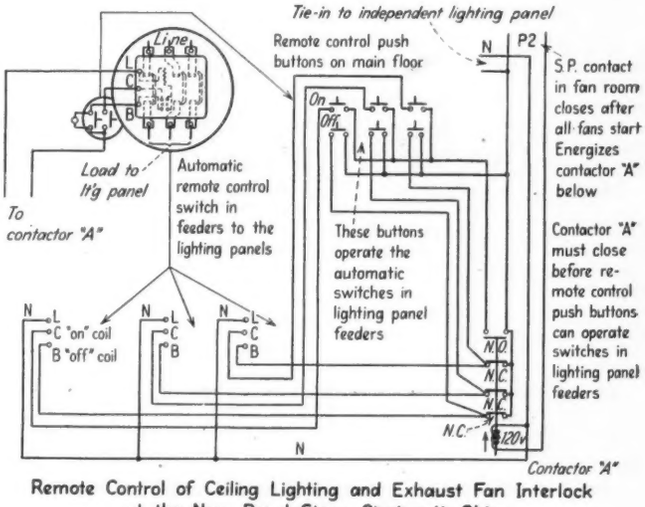
ELECTRICAL CONTRACTOR—Bertke Electric Co., Inc., Cincinnati, Ohio

TYPICAL CABINET for remote mounting of 12,000-volt cold cathode transformers. Each cabinet contains ten units enclosed in individual ventilated steel boxes with hinged covers.

CLOSEUP of 12,000-volt transformer installation showing safety features: (A) McDermott protector relay; (B) door-operated primary disconnect switch; (C) rubber insulated mounting.



McDERMOTT PROTECTOR relay circuit schematic diagram and transformer connection diagram.


Tie-in to independent lighting panel
Line
Remote control push buttons on main floor
N
P2
S.P. contact in fan room closes after all fans start Energizes contactor "A" below
On
Off
Load to ltg panel
To contactor "A"
Automatic remote control switch in feeders to the lighting panels
These buttons operate the automatic switches in lighting panel feeders
Contactor "A" must close before remote control push buttons can operate switches in lighting panel feeders
"on" coil
"off" coil
N.O.
N.C.
120v
Contactor "A"
Remote Control of Ceiling Lighting and Exhaust Fan Interlock at the New Bond Store, Cincinnati, Ohio

WIRING DIAGRAM of electrical interlock between luminous ceiling lighting feeders and store air conditioning control.

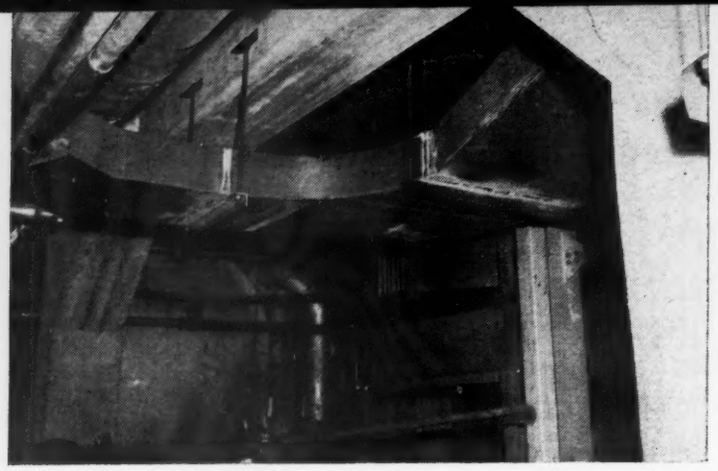
The electrical interlock is so designed that not a single ceiling light can be on before all air-conditioning fans are operating. This is accomplished by inserting an automatic remote control switch in each of the three lighting feeders serving the ceiling area (two for the cold cathode system; one for the incandescent system). Three remote control push buttons located on the main floor operate these switches. However, before the pushbuttons can function in the "on" position, a master contactor interlocked with the air-conditioning fan control must close its normally open contact. This happens only after all fans have started and are operating. Conversely, should the air-conditioning system fail, this contactor opens and power to the ceiling lighting is cut off.

Lighting on Other Floors

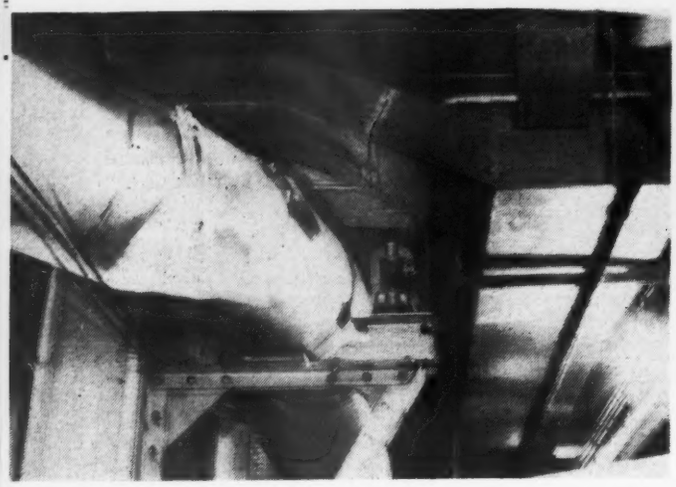
Generous use is made of soft cold cathode cove lighting and direct incandescent downlighting on other sales floors where suits, coats and other garments are displayed in recessed display cases and niches and glass-topped island racks. The same Bond pink color is used in the irregular continuous coves. Conventional fluorescent recessed units are used to advantage in offsets under the coves. Recessed wall cases are illuminated by continuous fluorescent strips mounted to the front of the case; manikin displays are highlighted by adjustable semi-flush ball spots.

Combinations of the various types of lighting are proportioned to meet the sales requirements on different floors. All utilize illumination to the best advantage for displaying merchandise while still retaining a soft lighting atmosphere for customer comfort and the pleasing display of merchandise.

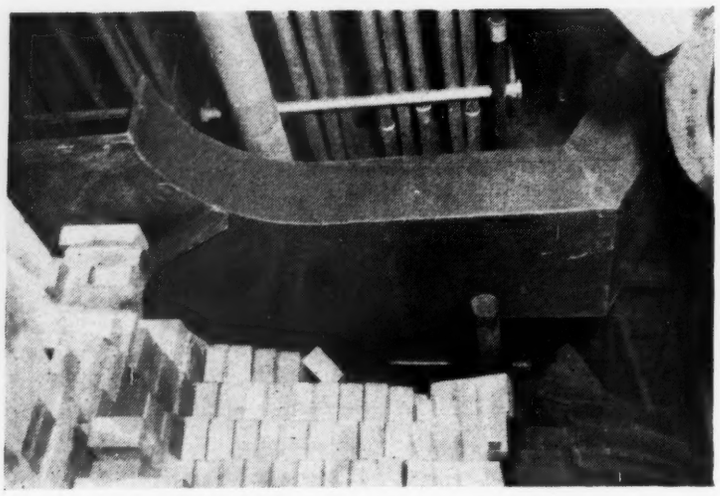
PAN SECTIONS are welded together; mounted snugly to ceiling beams by trapeze hangers.



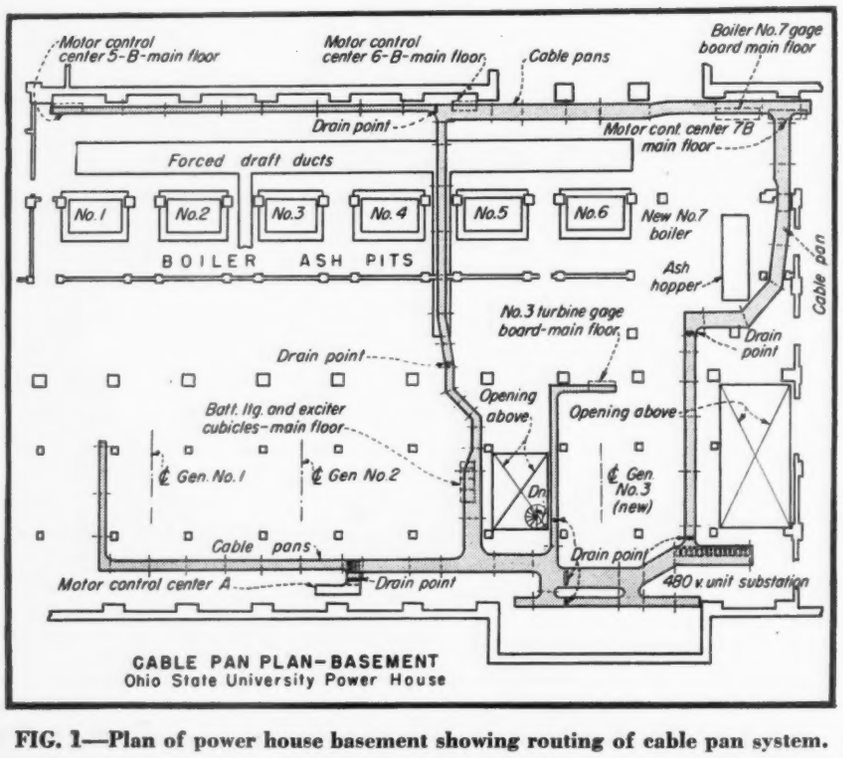
INSIDE CORNERS of right angle bends are rounded to facilitate cable pulling.



PAN CHANGES elevation and direction to bridge large steam line.



TEE CONNECTION to pan offset over forced draft fans in front of boilers.



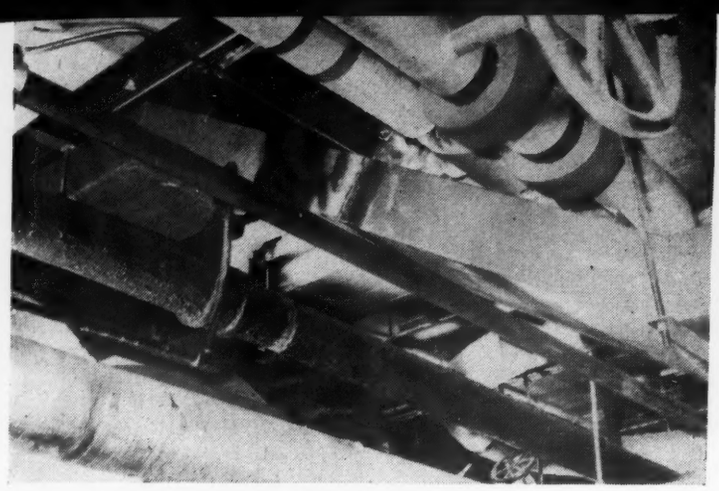
CABLE PAN PLAN—BASEMENT
Ohio State University Power House

FIG. 1—Plan of power house basement showing routing of cable pan system.

HIGHWAY

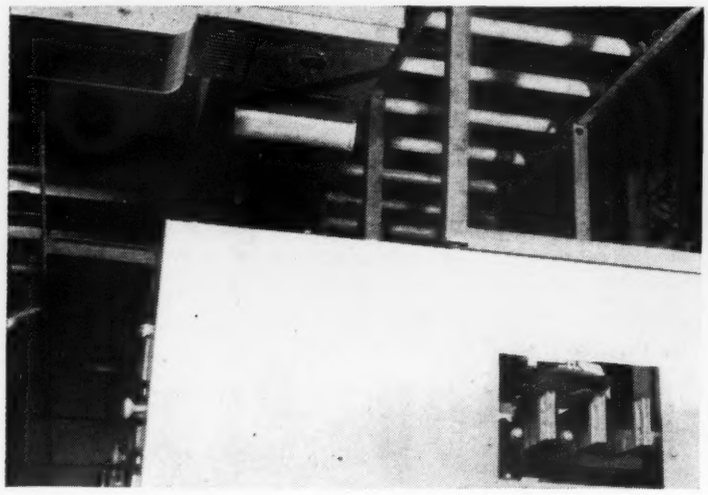
TO meet the increased power load demands of its postwar expansion program, Ohio State University (Columbus) is adding a 5,000 kw. generator to its power plant; rehabilitating the auxiliary control system; and adding new feeders to its campus distribution circuits. In addition to auxiliary control cubicles for the new unit, new control centers are being installed for all existing motors in the station.

Such a rehabilitation program requires considerable shuffling and rerouting of control circuits as well as new cable installations. Biggest installation problem encountered: How to "snake" the numerous control cables over, under, through and around the maze of conduits, pipes and ducts in-

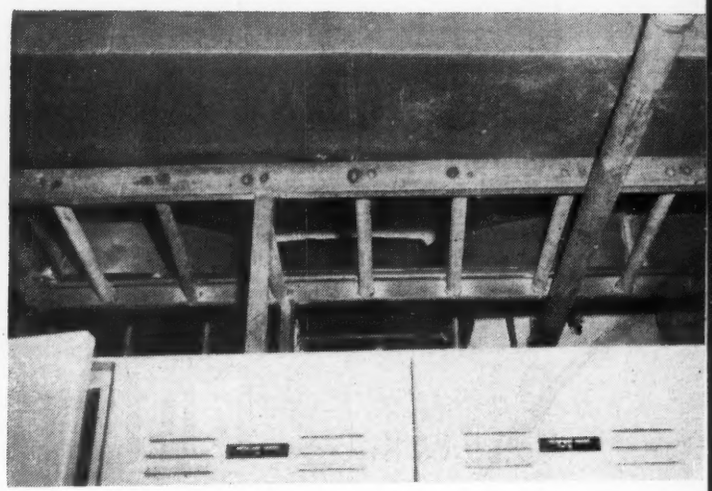


DOUBLE OFFSET in cable pan snakes between steam and water lines on power house basement ceiling.

AFTER MAKING a double offset, this pan section squeezes between steam line and ceiling slab.



PAN CONSTRUCTION over 480-volt unit substation cubicle in power house basement. Note cable rack under bottomless pan.



FRONT VIEW of cable rack and pan junction over unit substation cubicle.

for CABLES

stalled under the generating floor. Pulling in multi-conductor cables alone would be a major chore. Trying to install conduits would be practically impossible.

Sargent & Lundy, Chicago consulting engineers on the power plant project, solved the problem with cable pans, a continuous metal trough scheme they originated some years ago. The Gustav Hirsch Organization, Inc., Columbus electrical contractors, installed more than 560 feet of these pans to provide a wide, clear highway for the numerous multi-conductor VCL-SA control cables specified.

The pans, constructed of No. 12 gauge sheet steel, are nine inches high; vary up to four feet in width depending upon number and size of cables to be installed; come in 10-foot sections with necessary offsets, tees and corner sections fabricated to accurate dimensions and specifications. Sections are welded together to form the continuous raceway indicated on the plan view of the power plant basement.

Trapeze hangers hold the cable pans snugly to the bottom of ceiling beams; suspend them at higher or lower elevations where offsets go under or over pipe or duct lines. Hanger spacing varies with the width of the pan section in accordance with the following specifications:

15-ft. for pans up to 1½-ft. wide
12-ft. for pans 2- to 3-ft. wide
10-ft. for pans 3½- to 4-ft. wide

Inside bends on all corner pan sections are rounded (24-in. radius) to facilitate cable pulling and prevent cable damage. All power house water and drain lines are insulated where they cross over the troughs. Moisture drainage from the pan system itself is provided by screened openings at low points and where pans fan out at switchboards and cubicles.

Where cables enter cubicles from above, the pans are installed over and open directly on (pan bottom omitted) a specially designed cable rack. Conduit "rungs" spaced on 12-inch centers position the cables over the various circuit breaker sections.

To facilitate cable installation, Hirsch engineers used plain rollers (or a length of pipe) spaced at five-foot intervals in the cable pans. A single-sheave cable block was attached at each angle or bend. Cables normally were fed into the pans at cubicle locations and pulled in by a motor-driven winch at the other end of the run.

Although this cable pan system is used primarily in power plant work, electrical contractors can adapt the techniques involved, either whole or in part, to other installations where similar congested conditions may exist, giving complete protection.

AN AMPLE SUPPLY of fan speed control coils is wound during slack periods and kept in stock for rush jobs. Boxes on shelves contain pre-cut armature insulation stocks.

CHECKING A MOTOR for the proper size capacitor. Safe-T-Mike test set provides accurate determination of condenser size by turning selector and observing voltmeter.

PART OF THE PERPETUAL inventory of wound stators, armatures and spare shafts maintained for emergency repair jobs. Complete motors are also included in this stock.

Short Cuts to Shop Profits

LOST time is a rapidly diminishing quantity in the fractional horsepower motor repair department of the Industrial Engineering Equipment Company in Davenport, Iowa, one of the State's leading motor service organizations. Popular size, standard make motors can be completely rewound in less than two hours after the unit reaches the shop (baking time extra). Emergency jobs can be back on the customer's lines in a few hours.

Such service is the result of mass production techniques instituted by manager H. W. Pederson and shop superintendent V. E. DeLay (small motor dept.). And it shows up to advantage in the profit columns.

Secret of this department's success is the use of slack periods (when incoming repair orders drop off) to build up an inventory of preformed stator coils, pre-cut slot insulation, wedges and other items. Job simplification, one employee doing the same operation on all motors, permits use of less skilled help, cuts training time and increases employee efficiency. All are important considerations in the present labor market. The addition of time-saving features to standard equipment and a color-coded identification system for replacement parts further reduces lost time. Now, when a rush comes it can be taken in stride without disrupting shop routine and delivery.

Popular size coils are wound and formed in groups of six to 15 complete sets at one time. Slot insulation is edged, cut and crimped in large quantities. These items are then placed in storage boxes in the stator department to maintain a complete coil set inventory for about 80 motors. Each box, identified by a standard NISA rewind data card (yellow for RI units, red for split-phase) on the front, contains all the coils (starting and running), slot insulation, wedges and other items necessary to rewind one stator. When the rush comes, the girl merely takes a box off the shelf and she can have a stator rewound in about 20 minutes. A similar scheme is followed for slot insulation.

Also wound for stock during slack periods are various speed control coils (small auto-transformers) for commercial size electric fans. This is one means of rendering quick repair service.

Motorization of a standard hand operated insulation crimper is one of the numerous time-saving features added to shop equipment. Now the short pieces of slot insulation can be crimped as fast as they can be fed into the machine, a considerable time and energy economy when making insulation sets for the pre-formed coil stock. A $\frac{1}{6}$-hp., 110-volt, single-phase, right-angle gearmotor operates the crimper through a friction drive on the hand wheel.

Adjacent to the crimper is a paper cutter and insulation edger. On a wall rack behind the crimper, long lengths of pre-edged insulation are stacked according to widths ranging from $1\frac{3}{4}$-inch to $4\frac{1}{8}$-inch in $\frac{1}{8}$-inch steps.

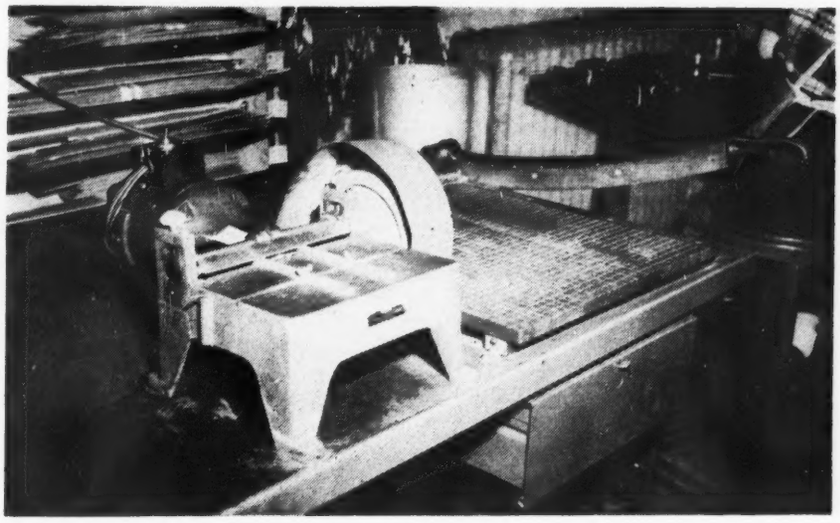
It only takes a few minutes to determine what size capacitor is needed for a motor on which data is not available. The addition of a Safe-T-Mike condenser test set to the dynamometer does the trick. The unit has 16 selector steps ranging from 32 to 600 microfarads; can also check size and condition of capacitors on incoming motors; is inexpensive and economical to maintain. Correct condenser size can be determined merely by a flick of a switch

REPLACEMENT PARTS BINS have color coded identification labels. Each color represents a different manufacturer's item. Example: An assembler working on a General Electric motor will always look for a red label; Delco, white and so on for seven brands.

PERPETUAL STOCK of pre-formed coils is maintained for about 80 motors. Each box contains all coils, insulation and wedges needed for a stator rewind. Rack at left holds pre-edged slot insulation strips prepared for instant installation.

Perpetual inventory of pre-formed coils, pre-cut insulation and other ideas to reduce lost motion keep this small motor department on the profit side of the ledger

By August Eckel



MOTORIZED INSULATION CRIMPER creases slot insulation as fast as it can be fed into the machine. Pre-edged insulation from wall rack is cut to length on board at right of unit.

and observation of a voltmeter reading.

Complete fractional horsepower repair service for motors is offered by this shop. This requires a stock of hundreds of replacement parts for each make of motor. Parts are stocked in bins sectionalized according to function (starting switches, bearings, etc.).

White—Delco
Red—General Electric
Orange—Emerson
Deep Blue—Century
Light Blue—Westinghouse
Pink—Marathon
Yellow—Howell
Cream—Miscellaneous category

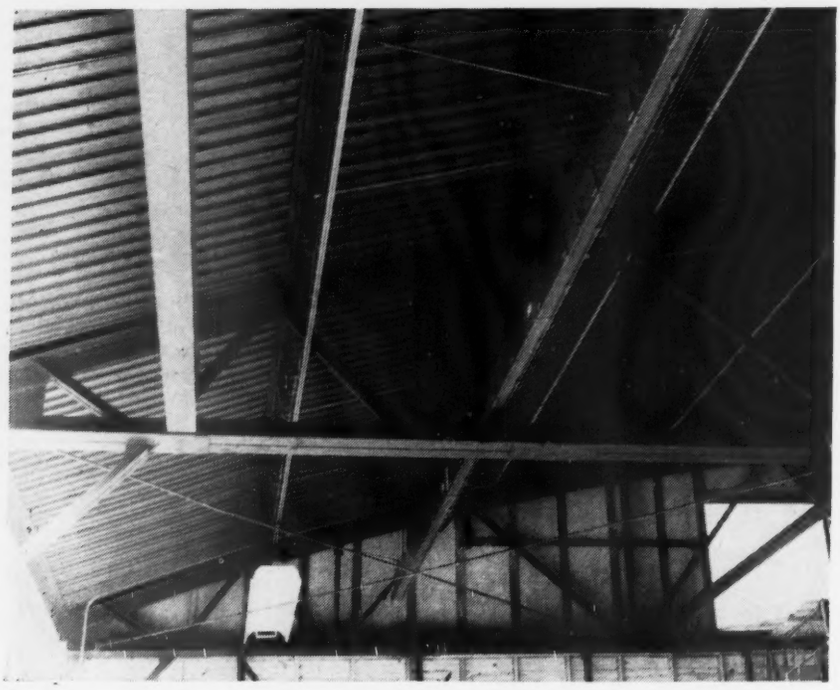
A colored card tacked on the front of each bin gives the bin number, manufacturers' code and part number, and the quantity stocked. Any section of the parts bins may have several different colored cards. Since an individual assembler usually works on only one make of motor, it is a simple matter for him to quickly spot his parts in the storage bins. No time is lost floundering around reading numerous bin cards before he reaches the brand he wants.

In an emergency, a completely rewound motor can be delivered to a customer in less than two hours. Basis of this type of service is a perpetual inventory of 30 to 35 rewound stators (10 different types) and armatures as well as shafts. Completely rebuilt motors are also stocked for loan purposes. When the customer's motor is repaired, it—or its parts—go on this shelf to replace the unit, or parts, he received in such a hurry.

Taken individually, the above ideas may not appear too significant from a cold time economy angle. Considered collectively in a single shop, they represent a significant reduction of lost motion and increase in overall department efficiency. They produced results in this shop.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

Practical Methods



Roof bar joists rigidly support trolley duct (left) for cold cathode lighting fixtures. Bus duct at right (3-phase, 4-pole) serves power needs and feeds trolley duct sections through remote control contactors.

Roof Bar Joists Support Trolley Duct

WIRING

Original plans specified that all power and lighting equipment be installed above the roof truss chords at the new Cambridge, Ohio plant of the Kingston-Conley Electric Company, Division of the Hoover Company. This included cold cathode industrial fixtures (four 8-ft. tubes per unit) which were to be mounted to trolley duct suspended from steel messenger cable.

To the Gustav Hirsch Organization, Inc., Columbus electrical contractors on the project, this meant the installation of six 580-ft. runs of messenger cable with the necessary dead-end facilities and intermediate supports. A study of the building construction convinced the electrical contractor there was a better way to do this; one that would be more economical for the owner and provide a more rigid fixture and duct support.

Roof construction consisted of steel trusses on 20-ft. centers with steel bar joists spanning bays. Except for a slight break at truss junctions, these joists provided a continuous supporting means for the entire length of the plant, and their spacing permitted close approximation of the specified 14-ft. center messenger cable runs.

The trolley duct runs were mounted to the bottom rods of the open steel joists. Standard messenger cable clamps were used. Chain drops from the trolley duct suspended the eight-foot (4-tube) fixtures. Individually fused flexible cord plugs provided the electrical connection between duct and fixture, a feature permitting quick replacement should a fixture go out.

Net result of the joist suspension: A more rigid support for the 348 fixtures in the main manufacturing area; better vertical and horizontal alignment; elimination of dead end, strain and intermediate support problems; an installation cost economy. When repairs, relamping or cleaning of fixtures becomes necessary, entire unit is replaced, instantly restoring service.

Closeup of trolley duct and fixture suspension showing use of standard messenger cable clamps on joists, chain fixture suspension and individually fused flexible cord plug connections to duct. Rigid alignment of fixtures and reduced strain on cables are resultant factors

Working Platform On Crane Truck

MAINTENANCE

Top use of materials handling equipment can be secured by scheduling its operations, and using it to perform additional work during periods when the equipment would otherwise be idle. As an example, a crane truck, in addition to performing duties related to loading and unloading rail cars or handling raw materials in a plant yard, can be used for installing and maintaining overhead fixtures. This application is made possible by mounting a platform on the end of the boom of a Yale and Towne crane truck. The positioning control of the electric truck permits easy and accurate positioning of the platform and the mobility of the truck makes it possible to follow the job closely. This attribute is a valuable asset in painting ceilings, checking wiring, installing conduit and maintaining lighting fixtures.

National Electric Wirewa-

EXPOSED WIRING UNDER COVER

Where exposed wiring would be subject to hazards—put it under a steel cover . . . quickly . . . easily . . . with National Electric 4 x 4 WIREWA . . . Practically the same accessibility of an exposed wiring system—PLUS . . .

- Permanent protection
- Easy to reach for wiring changes
- Plenty of room . . . 16 sq. inches of WIREWA for wire fills
- Multiple KO'S for conduit take-offs
- Easy to install . . . Sections securely joined by hinged couplings . . . Fittings for every requirement
- Low maintenance . . . Simple to re-route and extend . . . 100% salvable.
- Listed and approved by Underwriters' Laboratories, Inc.

The booklet, "A Wirewa You'll Like," illustrates all fittings and contains installation data. We'll gladly send you a copy.

THIS ACCURATELY MADE HINGED COUPLING speeds installation . . . adds rigidity to sections for lifting into place, and serves as a hanger. Simply place around sections to be joined, tighten two bolts, and the job is done!

NATIONAL ELECTRIC PRODUCTS
NE
WIRING SYSTEMS
WIRES AND CABLES

National Electric
PRODUCTS CORPORATION
PITTSBURGH 30, PA.

Simplex Varnished Cambric Cables are the work horses of the electrical industry. As shown, this cable has three conductors with a thick wall of varnished cambric tape. A varnished cambric belt for additional electrical protection is added and then a lead sheath is applied. A non-migrating lubricating compound is used between layers. It gives the cable greater flexibility and prevents wrinkling of the tapes when the cable is bent.

Simplex Varnished Cambric Cables have exceptional electrical stability and the ability to withstand ozone, mineral oil, voltage surges and high temperatures. They can be bent to a much shorter radius and are less likely to be injured in jointing than are paper cables.

Varnished Cambric Cables may be protected by treated braids, rubber or reinforced rubber jacket, interlocking metal tape (Condex), lead sheath with or without armor. In wet places or where they may be exposed to appreciable amounts of moisture, they must be covered with a lead sheath.

Bulletin #108 will be sent promptly upon request.

Simplex

WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

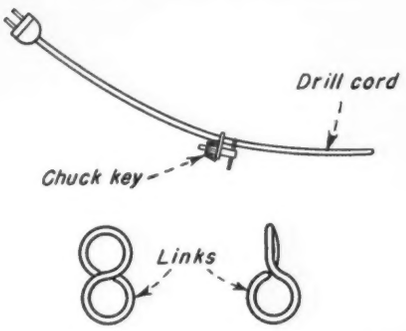
Yale and Towne crane truck serves multiple purposes when not in service on regular assignments in the shop or yard. Platform on top of the boom can be raised to exact position and moved freely as the job progresses. Safety railing, maintenance rack and tool box are features of the assembly. Platform is useful for maintenance, repair and installation work.

Several features result in safe and rapid installations. Safety railings prevent workers from slipping or falling. Racks, constructed as part of the railing framework, hold fixtures and boxes of lamps. A small box clamped to the railing holds tools and small parts for the maintenance or repair man. By proper scheduling, regular assignments of the truck are not interfered with, and high-bay work, normally requiring scaffolding, ladders and additional personnel, is performed efficiently and economically.

Link Holds Chuck Key

CONSTRUCTION

When using portable electric drills, the chuck key for the drill often becomes misplaced or is not available when it is needed. A simple method for insuring the constant presence of the chuck key is to attach the key to the cord of the power drill by means of small chain links. The links can be pried open, slipped over the key and cord, and forced into their original position again. The links will slide freely along the cord, permitting freedom of movement when using the key, and the key is always convenient.

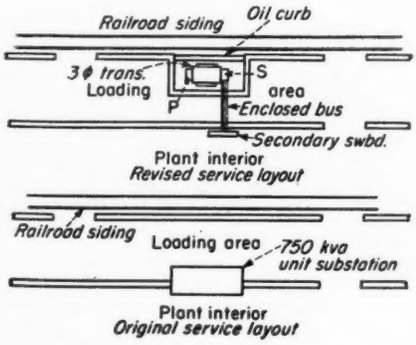


Small chain link holds chuck key to cord of portable electric drill.

Loading Dock Substation

WIRING

For a while it seemed that production at the new Cambridge, Ohio plant of the Kingston-Conley Electric Company, Division of the Hoover Company, would be delayed. Two 750-kva. unit substations ordered to serve the plant could not be delivered for some 18 months. Then the management of the Hoover Company started scouting around for a suitable substitute.



Plan of section of loading dock showing semi-vault for oil-cooled transformer.

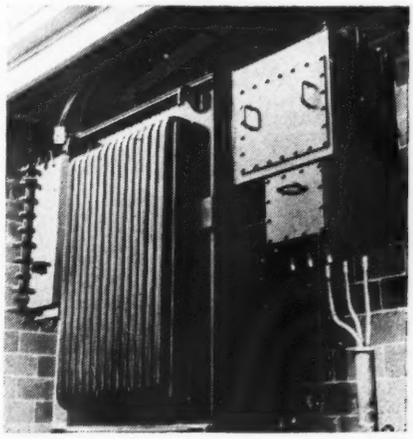
They located two Army surplus 600 kva, 3-phase, 4100/120/208-volt oil-cooled transformers. Plans were altered to suit this equipment which was installed by the Gustav Hirsch Organization, Inc., Columbus electrical contractors on the project.

Originally, the unit substations were to be spotted at power load centers on one side of the 634-ft by 114-ft plant and installed in the wall separating the manufacturing area from the enclosed loading dock which runs the full length of the building. The back of the substations were to project into the loading dock while the fronts were accessible from the plant interior.

If installed in these locations, the oil-cooled transformers would require an enclosed vault that would occupy valuable production floor area. To avoid this, the substitute units were installed at the outer edge of the loading dock (see photo). A three-sided concrete block enclosure (projecting into the loading dock "runway") was added, as was an oil-retaining concrete curb at the outside edge of the area. Underground primary ducts were shifted to feed the transformers in their new locations.

Enclosed secondary busses will span the dock to tie the transformers to a secondary switchboard inside the manufacturing area. Temporary connections from the transformers to bus duct distribution circuits in the plant got production under way before the entire electrical system was completed.

Although necessity forced this substitute scheme on the engineers, it has the distinct advantage of accessibility. The railroad siding parallels the loading dock. Transformers can be easily slid from the freight car right into position in the semi-enclosed vault. If a unit should fall, a replacement could be quickly installed.



Loading dock substation houses 600 kva. 3-phase transformer.

When installing mercury lighting

You Save 4 Ways

with G-E Tulamp ballasts

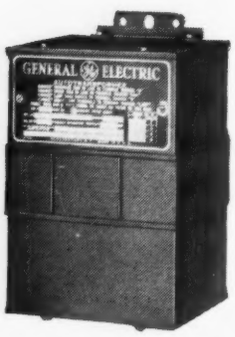
Tulamp ballasts combine the ballasts for *two* mercury lamps into *one* compact unit. This means: number of ballasts is cut in half—power factor is raised above 90 per cent by inherent design—stroboscopic effect is virtually eliminated. It means, when you install mercury-vapor lighting *with these ballasts*, you save four ways:

Save on Ballasts—A G-E Tulamp ballast costs less than a pair of single-lamp ballasts.

Save on Power—Losses are lower because the tulamp circuit is more efficient.

Save on Copper—Because of high-power-factor operation and lower starting current, smaller wire sizes can be used.

Save on Installation—Using Tulamp ballasts, only half the number of ballasts need be installed; smaller switches and fuses can be used; and installation is further simplified by carrying a common ground through to each pair of lamps.



Built by the largest manufacturer of Mercury H lamps, G-E Tulamp ballasts are designed for both H-1 400-watt and H-5 250-watt lamps. Single-lamp units—either uncorrected or high power factor—for operation of all standard lamps are also available. Contact your nearest G-E office or *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

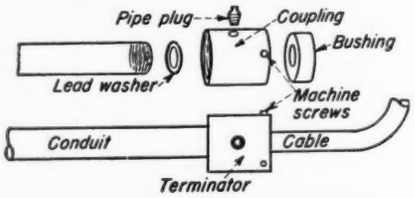
412-36

Watertight Fitting For Junction

CONSTRUCTION

When underground lead-covered cables are carried from a substation or into a building, it is desirable to establish a watertight seal at the points where the cable and the entrance conduits meet. This is to insure the exclusion of water from the various structures; water resulting from heavy rains, floods or stoppage of drainage systems. R. Menigall of Lake Worth, Florida, advocates a water seal consisting of a coupling, washer, bushing, plug, several machine screws, a small amount of okum and sealing compound.

The coupling serves as a terminal box and the watertight union between lead cable and conduit takes place at that point. To make an acceptable connection between conduit and coupling, the conduit is first fitted with the coupling. The lead washer is then inserted into the open end of the coupling and is lightly tamped into position against the conduit. This connection is further impregnated by packing okum around

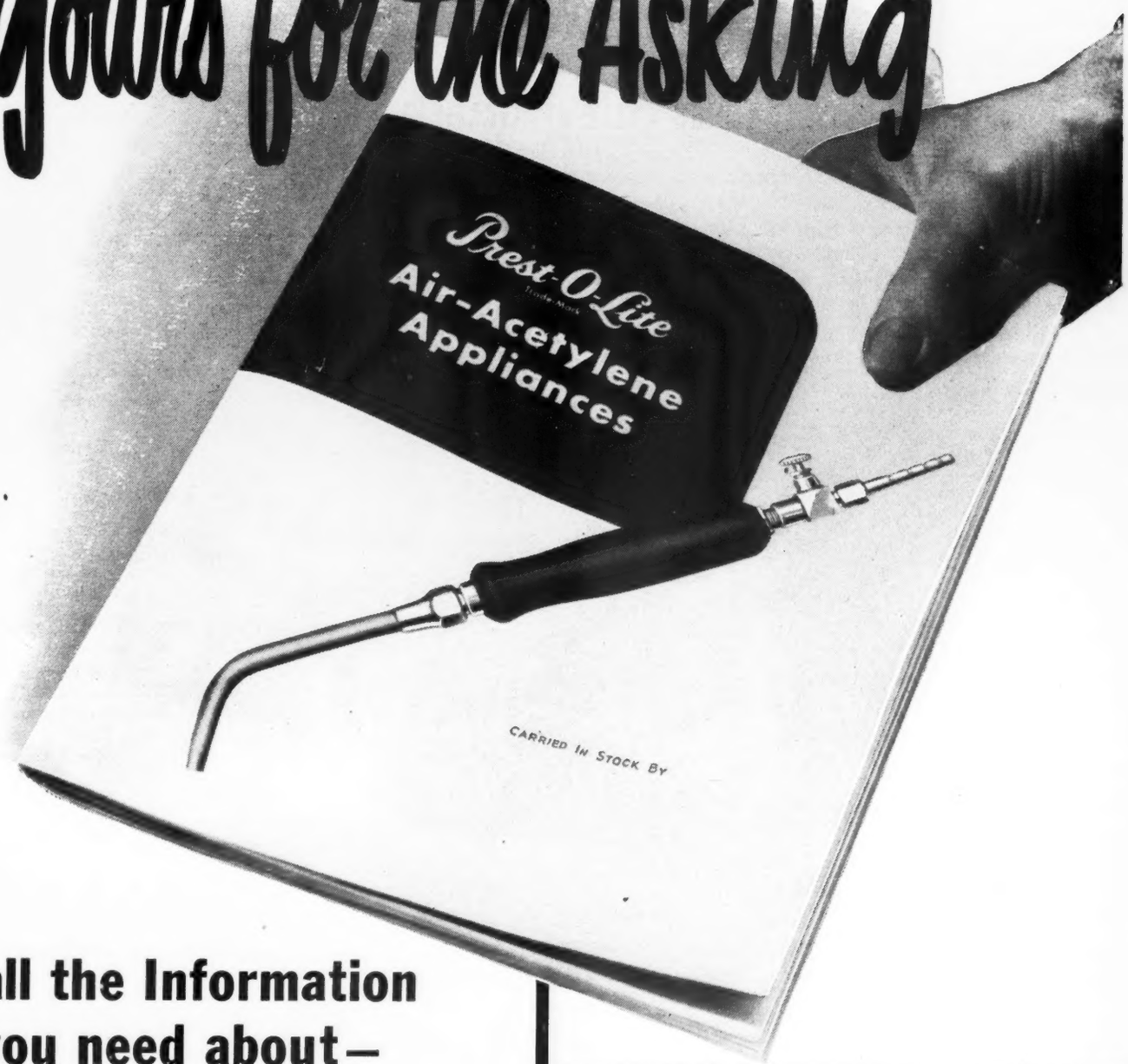


Watertight connection between conduit and lead-covered cable is achieved by sealing conduit-coupling junction with lead washer and okum. Cable-coupling junction is by means of ebony-asbestos bushing, also okum-sealed. Coupling is then filled with sealing compound.

the washer. The connection between coupling and cable is then established. Over the end of the cable is slipped a bushing made from either ebony asbestos or hard wood. The bushing is cut so that the inside diameter is slightly larger than the lead cable and the outside diameter of the bushing is minutely smaller than the coupling. When this bushing is inserted over the cable and into the coupling, okum packing is also used to seal the circumference cracks.

Machine screws are then inserted into pre-drilled and tapped holes at the bushing end, holding the bushing firmly in position. As a final step, the pothead sealing compound is heated and poured into the coupling through another, larger, pre-drilled and tapped hole in the coupling shell. When the coupling is filled, a small (quarter-inch) pipe plug is screwed into the pouring hole and the connection is finished.

Yours for the Asking



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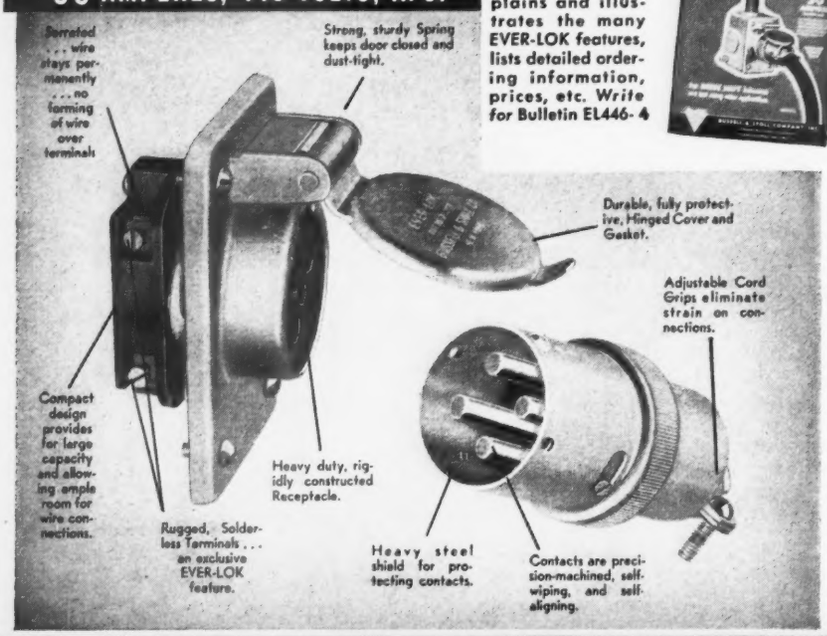
New EVER-LOK
RECEPTACLES, PLUGS & CORD CONNECTORS

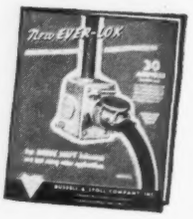
FOR HEAVY DUTY AND HIGH CYCLE APPLICATIONS

Here's a sturdy, 30 ampere, 440 Volts, A.C., capacity unit that means more jobs for you . . . more profits from installations everywhere . . . in industrial plants, factories, office buildings, department stores, hospitals, hotels, institutional buildings, and for many other heavy duty and high cycle applications. It's designed for easy, convenient wiring connections, and quick accessibility. And, of course, built by Russell & Stoll means the finest, sturdiest, and most advanced type unit available.

30 AMPERES, 440 VOLTS, A. C.


Serrated . . . wire stays permanently . . . no forming of wire over terminals
Strong, sturdy Spring keeps door closed and dust-tight.
Durable, fully protective, Hinged Cover and Gasket.
Adjustable Cord Grips eliminate strain on connections.
Compact design provides for large capacity and allowing ample room for wire connections.
Heavy duty, rigidly constructed Receptacle.
Rugged, Solderless Terminals . . . an exclusive EVER-LOK feature.
Heavy steel shield for protecting contacts.
Contacts are precision-machined, self-wiping, and self-aligning.

This Bulletin explains and illustrates the many EVER-LOK features, lists detailed ordering information, prices, etc. *Write for* Bulletin EL446-4



TYPICAL APPLICATIONS for EVER-LOK 30 AMPERE, 440 VOLTS, A. C., RECEPTACLES, PLUGS AND CORD CONNECTORS.

For connections to Electric Hammers.
For connections to heavy duty Sanding Tools.
Connected to high power Grinders.
Connected to Floor Polishing and Waxing Machines.
Connected to heavy duty Electrical Drills, etc.
Connected to large Vacuum Cleaners.

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56

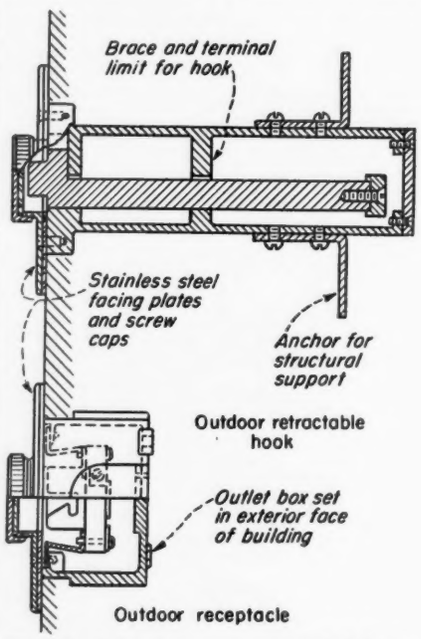
RUSSELL & STOLL COMPANY, INC.
Precision-Built Electrical Equipment
125 BARCLAY STREET, NEW YORK 7, N. Y.

Outdoor Receptacles For Special Display

LIGHTING

Shoppers of Houston, Texas, are setting first-year attendance and sales records in Foley's new, windowless, $12 million department store. Windowless construction introduces many new concepts of design, for the lack of exterior openings provides perimeter space for stock areas, eliminates dust infiltration, reduces heat losses during winter months and makes a completely objective lighting plan feasible. It also provides huge exterior wall surfaces which can be used for striking seasonal displays and unusual lighting treatments.

Two special devices, designed by Russell and Stoll, are utilized for these exterior surface displays. One is an outdoor receptacle. The other is a retractable display hook. Both outlets are set flush with the face of the store


Brace and terminal limit for hook
Stainless steel facing plates and screw caps
Anchor for structural support
Outdoor retractable hook
Outlet box set in exterior face of building
Outdoor receptacle

Electrical displays are suspended from retractable display hooks recessed into the exterior walls of Foley's new department store in Houston, Texas. Stainless steel 4-pole outdoor receptacles, wired on verticle risers, supply current for the displays. Both devices may be capped when not in use.

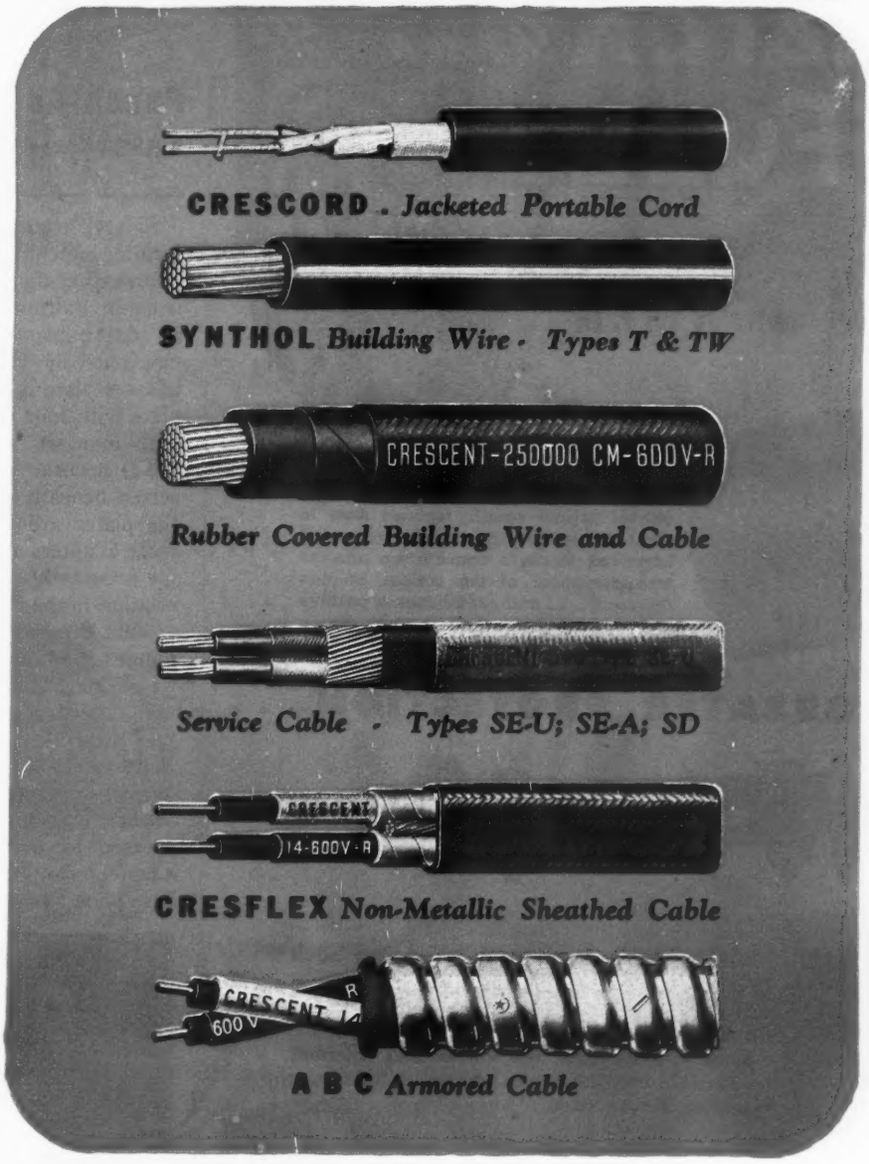
facing and can be capped for protection when they are not in use. When special displays are desired, however, the screw caps are removed, the retractable hook pulled from its housing to provide the means for suspending the display, and the adjacent receptacles provide current for lighting the presentations. Outlets are stainless steel. Receptacles are 4-pole, wired on vertical risers and controlled from first-floor lighting panels.

With the use of these devices, the

CRESCENT

Makes A Complete Line Of

ELECTRICAL WIRES AND CABLES



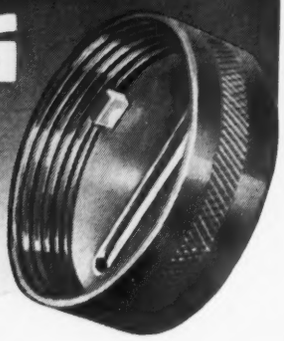
Distributed by principal electrical wholesalers throughout the United States. Their trained personnel and stocks are available to service your needs.

CRESCENT
WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

New POSITIVE LOCK Construction of Monarch Renewable Fuses

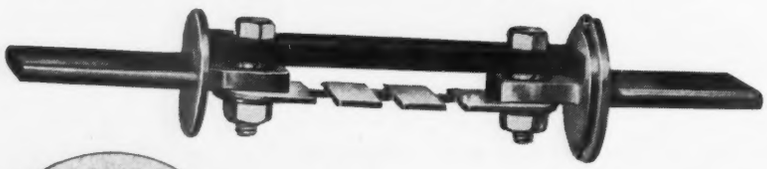
Assures → TRUE ALIGNMENT

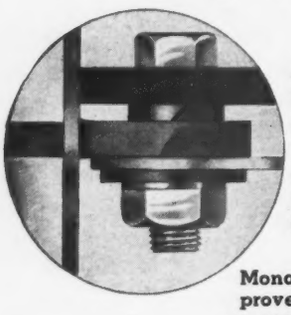


The brass lugs inside the caps used on Monarch Fuses (see illustration at right above) fit into equally spaced slots in the brass casing inserts. This new and improved Monarch construction assures true alignment of the copper holding terminals . . . and establishes a positive lock on both ends of the fuse.

and for

STILL GREATER PROTECTION . . .

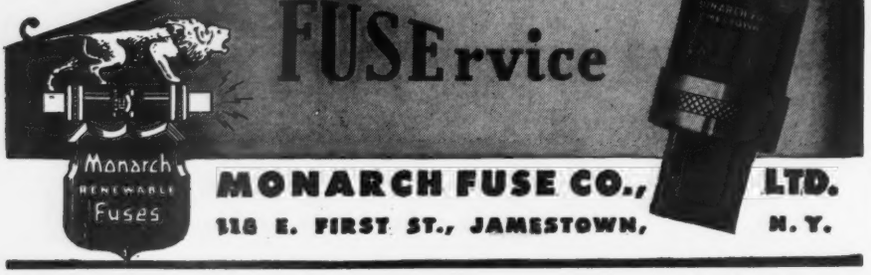




MONARCH'S Compressed Tension Lock Washer construction (illustrated at left) compensates for contraction and expansion of the fibre bar by exerting constant tension on the bar . . . and assures no loose parts. The washer also separates the fibre bar from the copper terminals . . . a spacer to provide better cooling.

Monarch Fuses are fully approved and are available through recognized wholesalers.

Specify Monarch Fuses *for improved* FUSErvice



CARRYING THE NEWS OF INSULATED ALUMINUM CABLE ECONOMY TO EVERY CORNER OF AMERICA

3,700,000 people buy The Saturday Evening Post each week. From three to five times that many read it. To those 15,000,000-plus readers, Alcoa has been telling the story of aluminum's economy and easy handling. Full-page, full-color advertisements urge them to *figure it in aluminum.*

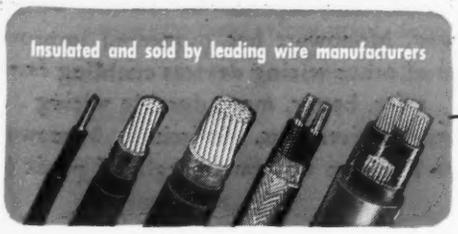
Among those 15,000,000 readers are the men who make industry's decisions on wiring. Plant and utility engineers. Architects. Builders. Your own men. And the men who make the decisions aren't just *reading* about aluminum. They're *buying* it.

Alcoa makes the light, strong, conductive E.C.* Aluminum, which leading wire and cable manufacturers draw, strand and insulate, and sell under their own trade-marks. They have it now.

Aluminum Company of America, 2197 Gulf Building, Pittsburgh 19, Pennsylvania.

*E.C.: *Electrical Conductor* Aluminum.

YOUR SUPPLIER HAS IT

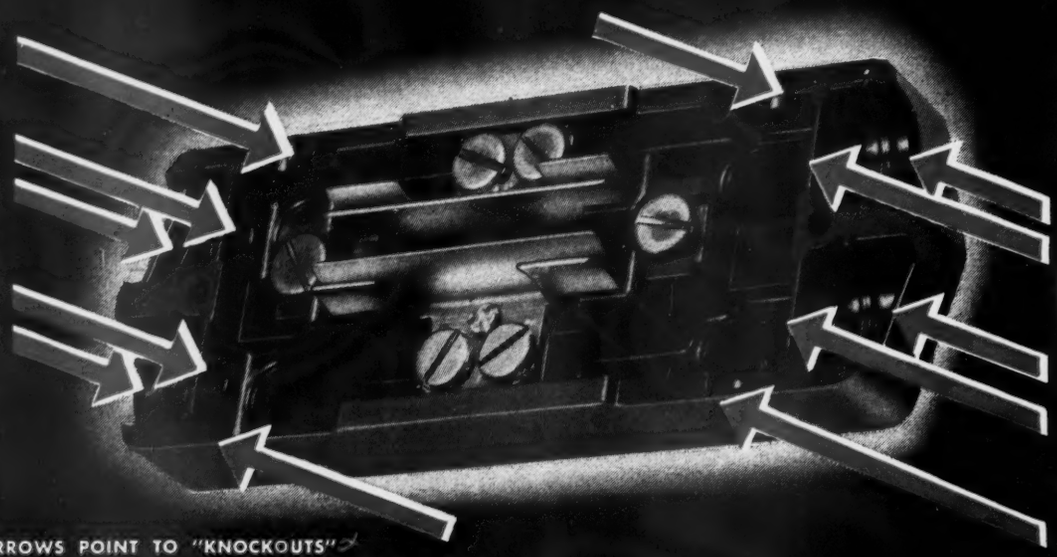


ALCOA EC ALUMINUM

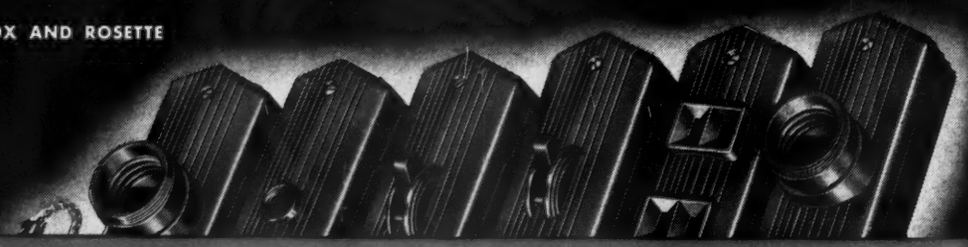
ALCOA ALUMINUM

FOR ELECTRIC WIRE AND CABLE

Use this amazing, low cost wiring method and land *more* contracts . . . . . .



ARROWS POINT TO "KNOCKOUTS"
JUST 6 RUGGED UNITS ANSWER EVERY PURPOSE
PULL-CHAIN LAMPHOLDER
COMBINATION JUNCTION BOX AND ROSETTE
SINGLE-POLE SWITCH
THREE-WAY SWITCH
DOUBLE OUTLET
KEYLESS LAMPHOLDER



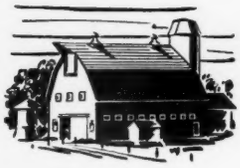
MONOWATT'S PLASTIC *SURFACE*

You'll pick up dozens of extra jobs with these Monowatt Surface Wiring Devices because you can run approved, dependable wiring *fast* and at *low cost.* Think how many new wiring jobs or extensions you can sell on this basis—farm buildings and warehouses; summer resorts and roadside stands.

Made of brown plastic, the devices are good-looking, tough, durable and light. They keep their color, resist moisture and corrosion and, unlike porcelain, do not easily chip or crack. Units triple as a box, switch or outlet and a plate. Plastic knockouts on ends and sides, as shown in the illustration, are easily removed with a screwdriver or pliers to make any device either "feed through" or "end run". The entire group meets REA and Federal Specifications and is listed by Underwriters' Laboratories for use with No. 12 or No. 14—2 or 3 conductor wire; non-metallic and armored cable with a special grounding clamp; also for building wire used with knob and tube work. Convenience outlets have double wipe contacts . . . switches are "T" rated . . . binding screws will take No. 12 wire.

By developing improvements in Surface Wiring Devices, Monowatt provides the answer to a country-wide demand for efficient, dependable, low-cost wiring. In the same way, Monowatt has pioneered improvements on a host of other wiring devices enabling faster installation . . . safer, better, more durable wiring . . . lower inventory requirements. Switch to Monowatt Wiring Devices and step up your margin of profit on any job!

YOU HAVE HUNDREDS OF PROSPECTIVE NEW CUSTOMERS



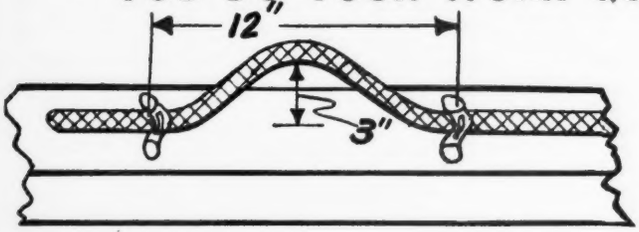
FARM BUILDINGS

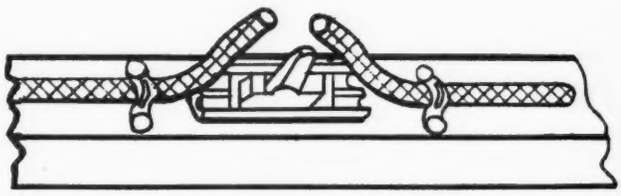
STORAGE SPACES
WAREHOUSES
STOCK ROOMS

ROAD STANDS
CABINS
RESORTS

ATTICS
BASEMENTS
GARAGES

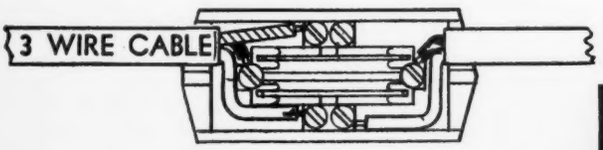
YOU DO YOUR WORK QUICKLY . . . . . EFFICIENTLY





1 **YOU RUN ALL YOUR CABLE FIRST** leaving a loop for each device you plan to install and wherever you think one may be required in the future.

2 **YOU QUICKLY CLIP EACH LOOP** and screw down the device. Here in a few minutes you accomplish what formerly took far longer because each unit triples as a box, switch or outlet and a plate.



DUPLEX RECEPTACLE

3 **YOU STRIP AND ATTACH WIRES** to large binding screws. Attach cover and move on. No soldering of splices or special connectors required. What could be easier?

WIRING DEVICES

WHY MONOWATT LEADS

SIMPLIFICATION of many traditional wiring devices results in quicker, more efficient wiring . . . many products with multiple adaptations benefiting the user . . . a substantial cut in your inventory because a complete wiring job can be obtained from just a few basic Monowatt devices.

\+ **PRODUCT DEVELOPMENT.** New, exclusive products have been created. Outmoded wiring devices have been replaced for safer, better, more durable electrical installations.

\+ **MANUFACTURING KNOW-HOW.** Superior manufacturing methods at Monowatt are productive of better wiring for more people at lower costs.

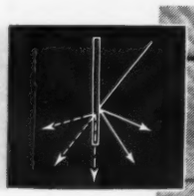
\+ **QUALITY CONTROL.** The Underwriters' Seal plus modern standards of quality processing insure long, trouble-free service from Monowatt products.

= **GREATER VALUE**

as announced in TIME.

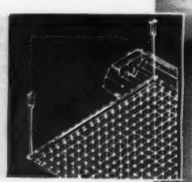
"SKY-GLO" CONVERTS OLD CEILINGS INTO GLOWING NEW ONES!

luminous



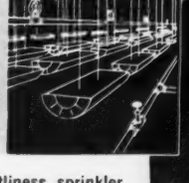
Unlike wood or metal "egg-crate" louvers, "Sky-Glo" not only reflects light but is translucent, having a light transmission factor of 71%. It is made of non-flammable Vinylite, product of the Bakelite Corporation.

costs less



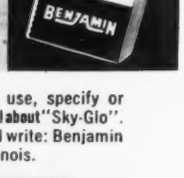
"Sky-Glo" is a system of channels, fittings and louvers of standardized sizes which makes it easy to fit a "Sky-Glo" ceiling to any size room. The simple, quickly assembled units reduce cost; actually "Sky-Glo" costs less than the usual conventional false ceiling.

hides ugliness



With "Sky-Glo" the usual overhead unsightliness, sprinkler heads, pipes, obsolete ceiling decorations and "forest" of conventional lighting units required to provide comparable levels of illumination are replaced by an ultra-modern, continuous sky of unobtrusive light.

know "Sky-Glo"



"Sky-Glo" heads a trend. Whether you use, specify or install lighting equipment you MUST know all about "Sky-Glo". For comprehensive "Sky-Glo" Data Manual write: Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

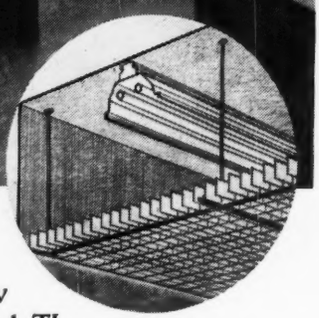
BENJAMIN

"Sky-Glo"

LUMINOUS LOUVERED LIGHTING SYSTEM

R 2941

Product of Benjamin Electric Mfg. Co., Des Plaines, Ill., The Nation's Largest Manufacturer of Lighting Equipment—Established 1901—Makers of a complete line of lighting equipment for Industrial, Commercial, Play Area and Utilitarian Requirements. Distributed Exclusively Through Electrical Wholesalers.



"Sky-Glo" creates a new epoch in lighting application! The most important development since the advent of fluorescent lighting...

"Sky-Glo" is not just another improvement in lighting equipment! *It is a wholly new way to use light!* No other single improvement can do as much to modernize an interior as "Sky-Glo". It replaces overhead unsightliness with a continuous sky of glareless, shadowless, pleasant and stimulating light. Its unique lighting advantages stem directly from the development and adaptation of Vinyl Chloride Acetate (a Bakelite Plastic) to the "Sky-Glo" Louver System. The use of these translucent louvers makes possible *"A New Experience in Seeing."*

Industrial Electrification

ENGINEERING • INSTALLATION • MAINTENANCE

Oil Field Power Distribution—Part I

A discussion on planning, including cost data.

By W. C. Bloomquist
Industrial Power Division
General Electric Co.
Schenectady, N. Y.

APPROXIMATELY two-thirds of the cost of oil field electrification is for power distribution. The remainder is for motors and controls. Since the cost of motors and control is constant for given motor ratings, any reduction in the cost of electrification must be made in the power distribution system.

The determining factor in the distribution layout is the voltage drop in secondary lines. Various methods for reducing this voltage drop are discussed here, including charts for quickly estimating voltage drop for common systems and the "unit-load—unit. length" principle for rapid estimation of voltage drops where many calculations are involved.

Capacitors for power factor improvement offer so many advantages—both from economic and operating standpoints—that they should be considered for every oil-field electrification project irrespective of whether a power factor clause is involved in the power rate.

Since there are few published engineering data for determining the most economical distribution system, it is hoped that this information will fulfill that need. Examples are included to demonstrate the use of the data.

FACTORS INFLUENCING THE DISTRIBUTION SYSTEM

There are a number of factors which affect the layout and selection of the type of distribution system, such as: (1) Permissible voltage drop, (2) Cost of system, (3) Number and size of motors, (4) Well spacing, (5) Configuration of field, (6) Pole spacing, (7) Size and type of line wire, (8) Power rate clause, and (9) Service reliability.

Voltage Drop. Voltage drop is the main consideration and determines to a large extent the cost of the distribution system. This is true because power is supplied at low voltage, distances are relatively long for such low voltage distribution, and the operating power factor is low.

Distribution-system voltages are usually designated in terms of the transformer or sending-end voltage, but because of the practice among oil-field personnel of using the utilization voltage for the system voltage rating, that same practice generally will be used here to avoid confusion.

Good engineering requires that operating voltage be between 95 and 110 percent of the motor nameplate voltage. Although motors will operate at less than 95 percent of the nameplate voltage, and manufacturers guarantee operation at 90 percent allows some margin for the voltage drop occasioned by starting a motor. The voltage at the motor during starting should not be less than 80 and preferably 85 percent of the motor nameplate voltage.

In a well-planned system the voltage drops are distributed approximately as follows:

Primary line...	1–3 percent
Transformer ..	2–4 percent
Secondary line.	7.5–12.5 percent

The total should not be more than 15 percent at the remote-well location.

If capacitors are used for power factor improvement, the over-all voltage drop will then be less and in the order of 10 to 12.5 percent.

Use Load-center Principle of Power Distribution. Since the major part of the voltage drop is in the 440-volt lines, these secondary runs should be kept as short as possible, within the realm of sensible economics. The load-center principle of distribution is well suited to this type of distribution system. A fundamental principle of a load-center system is that power at primary voltage is brought directly to the load area where it is stepped down to utilization voltage and then distributed to the individual load areas over short secondary feeders.

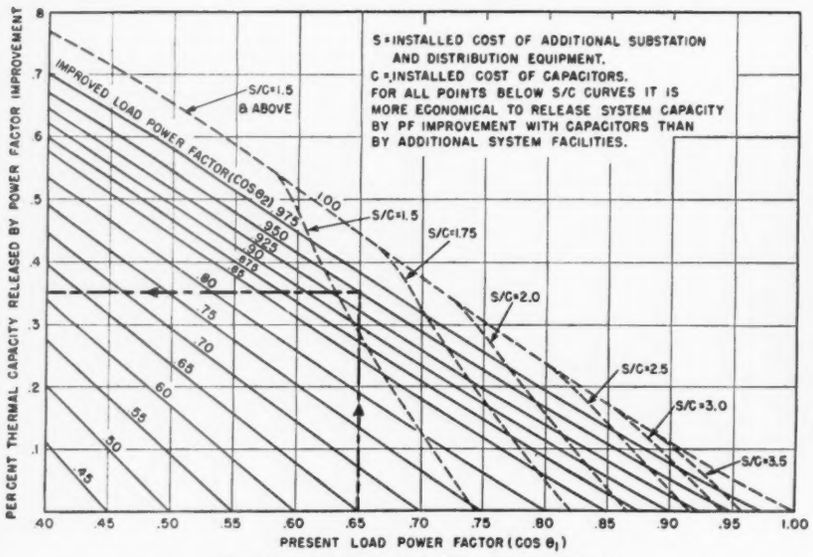
Selection of Primary Voltage. If utility power is used, the primary voltage is usually fixed by the utility practice and may vary from 2400 to 13,200 volts. If the primary voltage can be selected, 4160 volts is a good choice and allows for ample future expansion. System voltages above 4160 volts are seldom necessary in the average-sized lease, nor are they justified economically.

Reduction of Line Drop by Increased Conductor Size is Expensive. Consider the Use of Capacitors. In a 440-volt system it is expensive to reduce the voltage drop by increasing the conductor size.

For example, the voltage drop in a 1320-foot line (40 acre spacing of No. 2 ACSR with a 15 hp. motor operating at 60 percent power factor is approximately 2 percent. If the conductor size is changed to 2/0, the voltage drop is 1.4 percent. If the motor power factor is improved by capacitors to 97.5 percent, the voltage drop with a No. 2 conductor is also 1.4 percent, or equivalent to the larger No. 2/0 wire without benefit of power factor improvements. The line costs, including stringing and sagging, are:

No. 2/0 ACSR.. $288 for 1320 ft.
No. 2 ACSR.... $184 for 1320 ft.

Five kvar. capacitors are recommended for a 15 hp. high-starting torque, 1200


S=INSTALLED COST OF ADDITIONAL SUBSTATION AND DISTRIBUTION EQUIPMENT.
C=INSTALLED COST OF CAPACITORS.
FOR ALL POINTS BELOW S/C CURVES IT IS MORE ECONOMICAL TO RELEASE SYSTEM CAPACITY BY PF IMPROVEMENT WITH CAPACITORS THAN BY ADDITIONAL SYSTEM FACILITIES.
S/C=1.5 & ABOVE
S/C=1.5
S/C=1.75
S/C=2.0
S/C=2.5
S/C=3.0
S/C=3.5
IMPROVED LOAD POWER FACTOR (COS θ2)
PERCENT THERMAL CAPACITY RELEASED BY POWER FACTOR IMPROVEMENT
PRESENT LOAD POWER FACTOR (COS θ1)
PERCENT THERMAL CAPACITY RELEASED BY IMPROVING LOAD POWER FACTOR

EXAMPLE

IF THE LOAD POWER FACTOR OF A CIRCUIT IS IMPROVED FROM 65 TO 95 PERCENT, THE SYSTEM CAPACITY RELEASED IS 35 PERCENT; THAT IS, THE SYSTEM CAN CARRY 35 PERCENT MORE LOAD (AT 65 PERCENT POWER FACTOR) WITHOUT EXCEEDING THE NET KVA BEFORE THE POWER FACTOR WAS IMPROVED.

THIS CURVE ALSO SHOWS THAT IT IS MORE ECONOMICAL TO OBTAIN THIS AMOUNT OF SYSTEM CAPACITY BY POWER-FACTOR IMPROVEMENT WITH CAPACITORS THAN PURCHASING ADDITIONAL SUBSTATION AND DISTRIBUTION FACILITIES FOR ALL S/C VALUES ABOVE 1.55 (OBTAINED BY INTERPOLATION).

FIG. 1—The gain in system capacity is particularly attractive when the operating power factor is low.

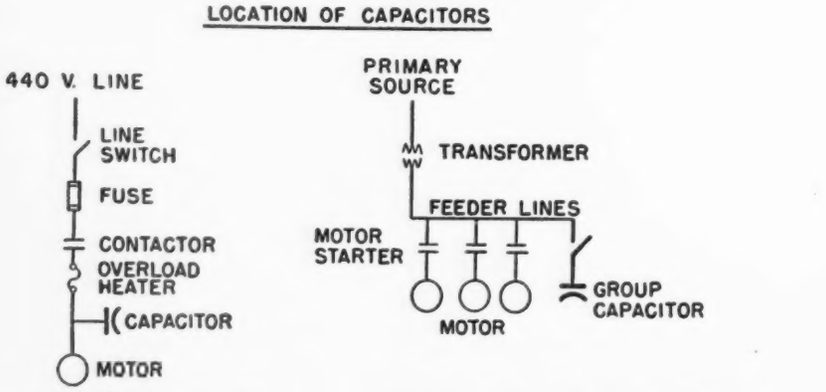


FIG. 2—For maximum over-all benefits, capacitors should be located at or near individual motors.

rpm. motor. The installed cost of capacitors is $12.50 per kilovar or $62.50. The net saving, in this case, with the capacitor method is $42.50.

Use Transformer Taps to Compensate for Voltage Drop in Primary Line and Transformer. Since the total load of an oil field is rather steady, consideration should be given to compensation of the voltage drop in the primary line and transformer by adjustment of transformer taps.

Most transformers are available with two 2½ percent taps (above and below normal voltage) at very little increase in cost, and in some ratings these taps are available at no increase in price. If it is possible to utilize the full 5 percent tap range in either direction, this will result in a large saving

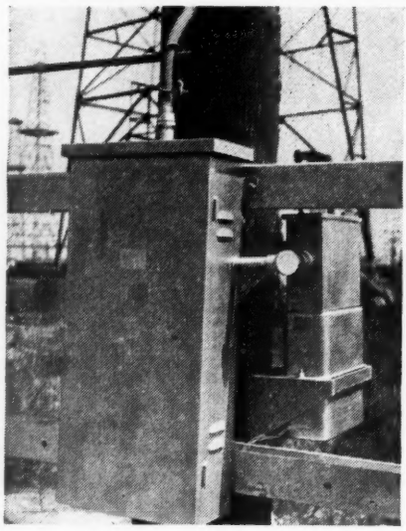


FIG. 3—Capacitors located on well pole and connected to load side of starter.

in conductor costs of secondary lines or permit more wells to be served from a substation location.

Use Voltage Regulator if Incoming Supply Varies. If the incoming supply voltage varies more than a few percent and the secondary-voltage levels are approaching the minimum operating voltage, a voltage regulator in the incoming service connection should be considered. A regulator assures *constant* voltage on the primary and, if desirable, the line-drop compensation feature can be incorporated to compensate for line and transformer drop.

Consider Individual Transformer Banks for Large Motors and Well Spacing. When the motor load and well spacing are large, the economics may favor the use of individual step-down transformers at the motor locations.

TRANSFORMER AND SYSTEM PROTECTION

Single-phase Transformer Units Preferable. Transformer banks may be made up of single-phase units or three-phase units. Generally, single-phase units are preferable in these small pole-type transformers.

Delta - Delta Transformer - winding Connections Recommended. There are several transformer-winding connections that can be used, for example, primary wye and secondary delta, delta-delta, and delta-wye. The delta-delta connection is generally used because: 1) Transformer banks can be operated open-delta in the event that one transformer is out of service. 2) Standard two-coil overload protection can be used in motor starters. 3) Motor burnouts are avoided due to single-phase operation, such as can occur in case a primary fuse or line is open

when transformer connections are wye-delta or delta-wye and the motor is protected by two-coil overload relays.

There is some misunderstanding regarding transformer primary connections on grounded or ungrounded, 3-wire, wye system, such as a 4160-volt system which is the wye of 2400 volts. Primary transformer connections are independent of the system connection or method of system grounding. Therefore, primary transformer connections can be delta regardless of whether the power system is wye or delta, grounded or ungrounded.

System Protection. When the transformer bank is connected to overhead exposed lines, lightning arresters should be included at each substation for maximum protection. The number of supplementary arresters, especially on the 440-volt lines, is dependent upon the frequency of the lightning in the particular area.

The 440-volt systems are invariably delta and ungrounded so arresters for ungrounded service should be selected.

Some means should be incorporated at each substation to automatically remove a transformer-bank from service under system faults or heavy sustained overloads. Fused cutouts are economical and are almost universally used for the transformer-bank sizes normally used in this class of service.

Ground connections to the motor-starter case, lightning arresters, and the pumping-unit frame should be well bonded to the common ground source, usually the well casing.

CAPACITOR APPLICATIONS

The power factor of oil well pumping loads is very low, because, first, the *average* load is only about 60 to 70 percent of the motor horsepower rating, and, second, many motors are underloaded, i.e., below the average of 60 to 70 percent.

Studies of several oil-field leases showed that layouts with capacitors resulted in the most economical arrangement on a first-cost basis. In addition, there is the saving in power costs due to the reduction in system losses, and there also may be a saving if a power-factor clause is included in the rate structure.

Where the usual power-factor clause is involved for billing purposes, capacitors generally pay for themselves in one or two years—or a rate of return on their investment of 50 to 100 per-cent.

The saving in system losses—ordinarily not even considered in oil-field layouts—is tremendous, because of the continuous day-in and day-out load.

TABLE I

Recommended Maximum Capacitor Rating When Capacitor and Motor are Switched As a Unit [1]

Representative data for three-phase, 60-cycle, splashproof, 50°C, 440-volt induction motors for oil-well pumping service

TYPE K TRICLAD MOTOR

(Normal starting torque)

Motor Horsepower Rating	Motor Speed in RPM 1800 KVAR[2]	1800 % AR[3]	1200 KVAR	1200 % AR	900 KVAR	900 % YAR
5	2	14	2	16	3	25
7.5	3	13	3	15	4	22
10	4	11	4	12	5	17
15	5	11	5	11	7.5	16
20	5	10	5	11	7.5	15
25	7.5	10	7.5	10	10	14
30	10	9	10	10	10	13
40	10	9	10	10	12.5	12
50	12.5	9	12.5	9	15	12
60	15	8	15	9	17.5	11
75	17.5	8	17.5	8	20	11

TYPE KG TRICLAD MOTOR

(High starting torque)

5	2.5	16	3	22	4	30
7.5	3	14	4	19	5	27
10	4	13	5	17	7.5	25
15	5	12	5	15	10	22
20	5	12	7.5	14	10	19
25	7.5	12	10	13	12.5	18
30	10	12	10	13	15	17
40	12.5	11	15	12	20	17
50	15	11	17.5	12	22.5	16
60	17.5	11	20	11	25	16
75	20	11	25	11	30	15

NOTES

[1] The motor power factor, with capacitor ratings listed in this table, will range from 95 to 98 per cent at full load, and 95 to 100 per cent at partial loads ranging from 50 to 75 per cent.

[2] Kvar is the rating of capacitors in kilovolt-amperes connected at motor terminals.

[3] % AR is the per-cent reduction in line current due to capacitors and is helpful in selecting the proper motor overload setting when the overload relay is located as shown in diagram (A) Fig. 2

System power losses are proportional to the square of the current (I^2), and since current is reduced in direct proportion to improvement in power factor the losses are inversely proportional to the square of the power factor, or $(PF)^2$. *In oil-field distribution systems, with the relatively long secondary runs, it is not at all unusual for capacitors to pay for themselves due to reduction in system losses alone.*

Since the line current is less with an improved power factor, the voltage drop is less (which means more wells can be served or the wire size reduced); also the required substation capacity is less, resulting in a lower investment. It is because of the increased distribution, substation, and generating facilities required on the part of the utility to serve a low-power-factor load that a power-factor clause may be made part of the rate structure. Similarly, more investment is required if local generation is employed.

Therefore, with the possibility of savings in power costs due to a power-factor clause, reduction in system investment, and savings in system losses, every oil-field electrification plan should be investigated to determine the advisability of using capacitors.

Fig. 1 shows the percent system capacity released by power-factor improvement. It should be noted that the gain in system capacity is especially attractive when the operating power factor is low, such as is true of oil-well pumping service.

These data also show the economic limits of capacitors versus additional substation and distribution facilities for releasing electrical capacity.

Location of Capacitors. Capacitors may be connected to the motor or on a feeder as shown in Fig. 2. When

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TABLE II

Power-Factor Improvement Table

(Figures below multiplied by kw input = kvar of capacitance required to improve from one power factor to another.)

Original Power Factor in Per Cent	Desired Power Factor in Per Cent								
	85	87	90	91	92	93	94	95	100
50	1.112	1.165	1.248	1.276	1.303	1.337	1.369	1.403	1.732
52	1.024	1.077	1.160	1.188	1.215	1.249	1.281	1.315	1.644
54	0.939	0.992	1.075	1.103	1.130	1.164	1.196	1.230	1.559
56	0.860	0.913	0.996	1.024	1.051	1.085	1.117	1.151	1.480
58	0.785	0.838	0.921	0.949	0.976	1.010	1.042	1.076	1.405
60	0.714	0.767	0.850	0.878	0.905	0.939	0.971	1.005	1.334
62	0.645	0.698	0.781	0.809	0.836	0.870	0.902	0.936	1.265
64	0.580	0.633	0.716	0.744	0.771	0.805	0.837	0.871	1.200
65	0.549	0.602	0.685	0.713	0.740	0.774	0.806	0.840	1.619
66	0.518	0.571	0.654	0.682	0.709	0.743	0.775	0.809	1.138
68	0.459	0.512	0.595	0.623	0.650	0.684	0.716	0.750	1.079
70	0.400	0.453	0.536	0.564	0.591	0.625	0.657	0.691	1.020
73	0.316	0.369	0.452	0.480	0.507	0.541	0.573	0.607	0.936
75	0.262	0.315	0.398	0.426	0.453	0.487	0.519	0.553	0.882

EXAMPLE

What kilovars of capacitors (capacitor kvar) are required to improve the power factor from 65 to 95 per cent for a 150-kilowatt load?

From the table, the kilowatt multiplier is 0.84. The kvar required is 150 × 0.84 = 126. Use 120-kvar bank, the nearest standard.

capacitors are connected to the motor terminals, the motor and capacitor are switched as a unit by the common motor starter. In this case the capacitors are usually located at the motor starter, and the capacitors connected to the load side of the starter.

For maximum over-all benefits, the capacitors should be located at the load; i. e., at or near individual motors.

Figure 3 shows a typical capacitor installation.

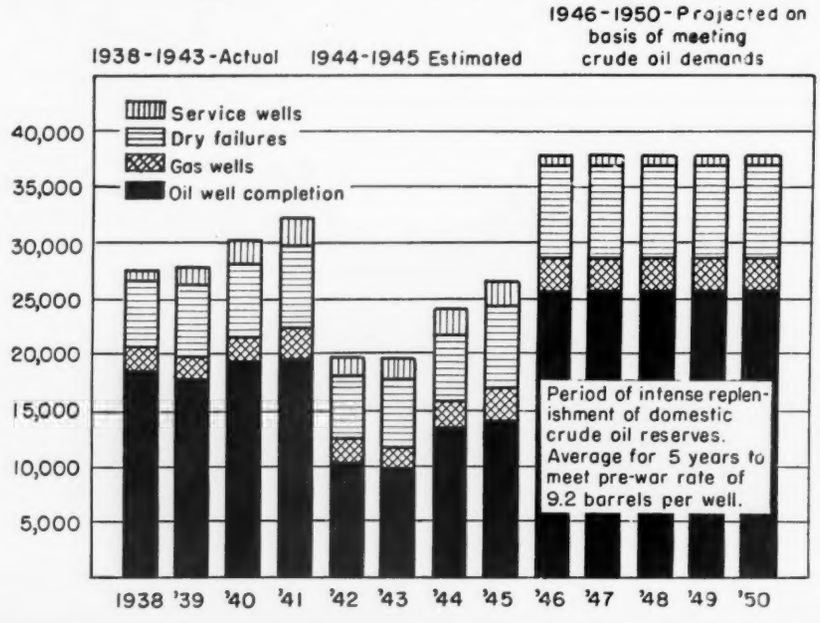
Selection of Required Amount of Capacitors. Table I lists the recommended capacitor kvar. value for use with motors. The resulting motor power factor in the operating range for oil-field loads is 95 to 100 percent.

When capacitors are connected to the motor terminals, motor underloading has very little effect on the operating power factor.

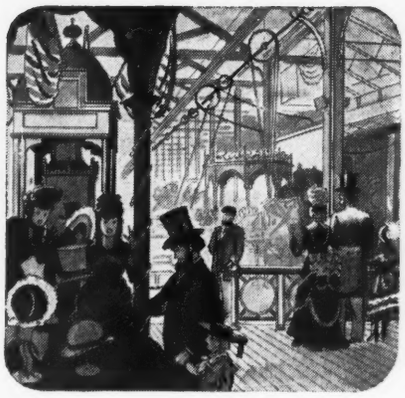
Since the motor current taken from the line is reduced when capacitors are connected to the motor terminals, allowance should be made for this to properly protect the motor against overloading. Table I gives the approximate percent ampere reduction (%AR) due to capacitors and is useful in selecting the proper motor overload heater element.

Table II gives information for selection of the capacitor rating for the group capacitor method of power-factor improvement.

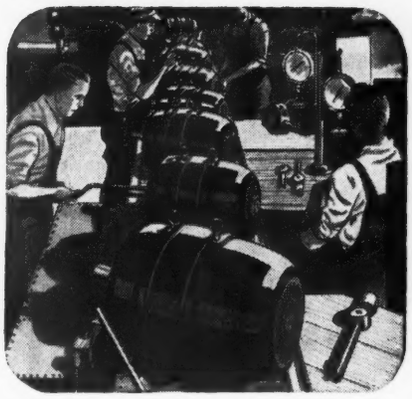
UNITED STATES WELL COMPLETIONS



1 1780—Already the newly created Republic felt stirrings of the industrial greatness ahead. A Connecticut hat maker, for example, experimenting with *techniques* of increased production, pushed output to three a day.



2 1876—Mechanical marvels by the thousand at the Philadelphia Centennial dramatically spotlighted America's ability to invent, design, produce. Industrial stage was now set for impact of low-cost electricity, soon to come.



3 1915—Howell "Red Band" Electric Motors appeared! Soon, these rugged, industrial-type motors won recognition in hundreds of vital industries. Assembly lines were on the move! Ford produced its millionth car!

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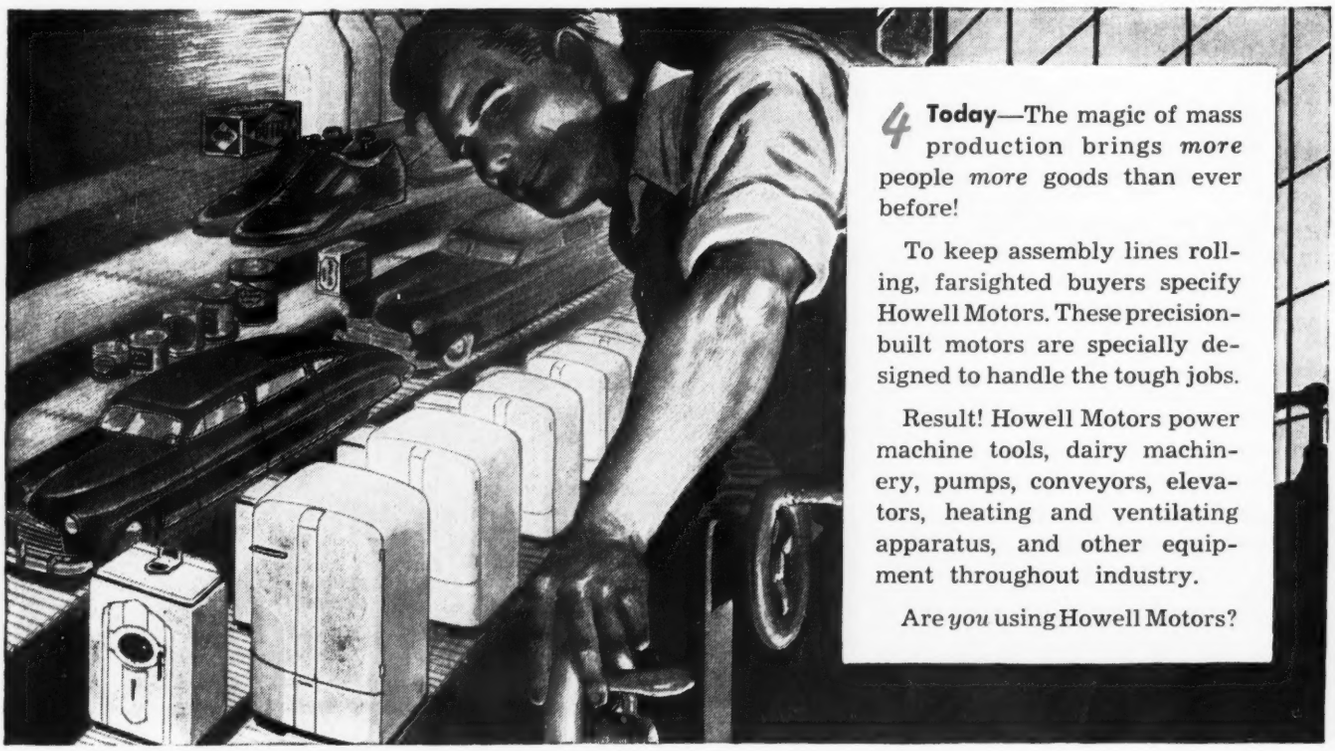

4 Today—The magic of mass production brings *more* people *more* goods than ever before!

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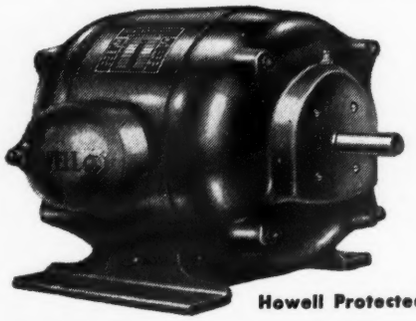

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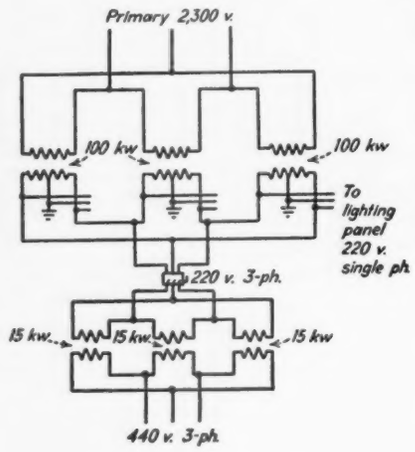
Reader's Quiz

Transformer Hook-Up

QUESTION 287—Is the hook-up of the transformer, as shown in the sketch, wrong, and if so, why? While the conditions may be unusual, an interesting problem is involved on which I have received opposite opinions from several engineers.—J.J.W.



A. TO QUESTION 287 — As drawn, the diagram shows a short circuit in the large transformer bank. The mid-points of the 100 kw. transformers form a delta, with 110 volts potential between corners. This can be seen by arranging the transformer connection diagram in the form of a voltage diagram.

Section 2514 of the 1947 National Electrical Code requires a ground, and Section 2525 allows only *one* ground. The least maximum potential to ground would be obtained by grounding the midpoint of one phase. With this, the maximum on the 110/220 volt system would be 123 volts to ground.

Even with only one ground on the transformer bank, distributing the lighting load among the three phases as shown in the diagram is not advisable. Defective equipment connected to the two phases which are not grounded at their midpoints could provide a shock hazard or short circuit to ground. Grounding such equipment would come back to the basic fault of the connections as shown.

If it is desired to distribute the lighting load among the three phases, the secondaries of the larger transformers should be connected 120/208 volts wye. (The halves of the secondaries in each transformer would be connected in parallel.) 220 volt motors would operate satisfactorily.

The connections of the 45 kw. transformer bank would remain delta-delta. Some adjustment to the internal tap connections might be necessary for optimum 440 voltage conditions. If it was desired to eliminate the 45 kw. bank by taking 416 volts directly from the 300 kw. bank, the combined and balanced lighting and 220 volt motor loads could not exceed 127.5 kw.—L.E.B.

A. TO QUESTION 287—The hook-up of the transformer is radically wrong due to the fact that the mid-tap of the three 100 kw. transformer is grounded. This would put a short through the earth across the halves of the transformer so connected. Grounding all three would put the three transformers out of service either by blowing protective fuses or burning them up.

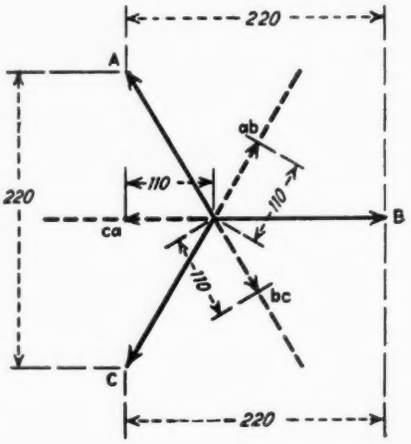
A ground on only one of the three lighting panels would work o.k. but it is forbidden by the Code, which limits the voltage to ground to 150 volts.

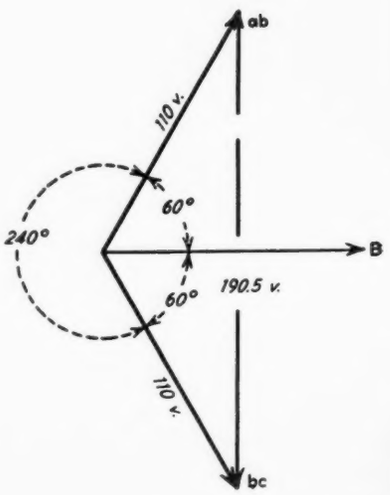
In regard to the 440-3 phase, it would be a question for the electrical engineer of the firm to figure out if the losses due to the retransformations exceed the installation of a 2300/440 transformer.—J.W.H.

A. TO QUESTION 287—I am afraid that the connections as shown will be impractical for the reasons which are outlined and diagrammed in this answer.

The trouble lies in the grounding of the 100 kva. transformers at midpoint of all three secondaries. Enclosed is a brief diagram showing the voltages at this point. Main voltages are A, B and C. The midpoint taps are (ab), (bc), and (ca). The three latter voltages while numerical in value differ from each other in plane angle by 120°. Hence, if all three are grounded, current will flow through the ground causing a short circuit. It therefore follows that between points (ab) and (bc) we have 110 volts at an angle of 60° and 110 volts at an angle of 300°.

The voltage between (ab) and (bc) would be 2 × sin. 60° × 110 v. or 2 × .866 × 110 or 190.5 volt as the figure is symmetrical, this would be the





voltage between all three midpoint taps.

A solution to this problem would be to ground only one transformer midpoint. This might bring objection to a higher voltage to ground of the midpoint of the other two ungrounded transformers if used for solid neutral lighting load.—J.E.C.

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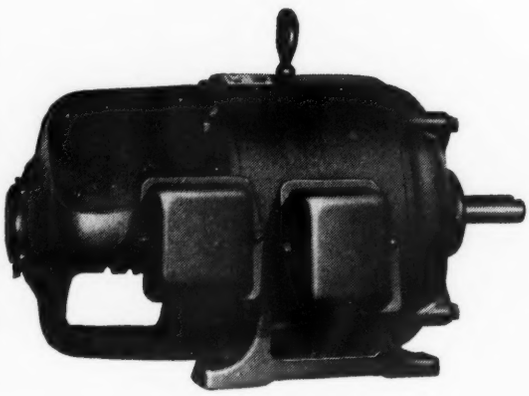

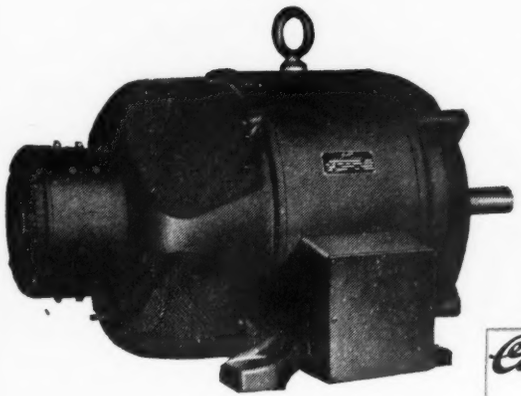

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Of course, large motors are protected by thermal cutouts or overload relays. These devices save many motors, BUT experience shows that they sometimes fail to operate and a motor burns out.

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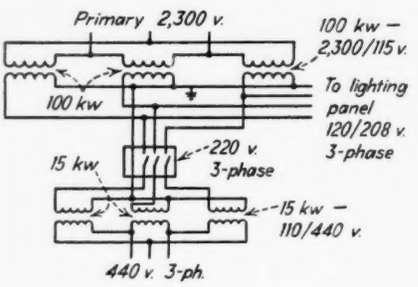
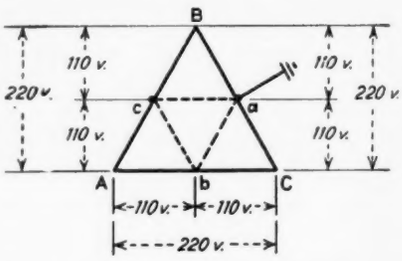
A. TO QUESTION 287—The main error in the hookup is in the grounding of all three center tapped 220 volt secondaries. One transformer only may be grounded with this connection. Because of the phase relations in the three secondaries there will be a potential difference of 110 volts between the center taps and the grounding of all three center taps would cause a heavy current to circulate, probably blowing the primary fuses, or overheating the transformers. The vector diagram on the three phase 220 volt secondary illustrates this condition.

The points A-B-C would represent the 3-phase 220 volt output. The





points *a-b-c* would represent the center taps of the transformers. An actual voltage difference of 110 volts exists between any two of the center taps. A 3-phase 110-volt load could be taken from points *a-b-c*. Therefore, only one of the center taps can be grounded without upsetting the voltage balances. Also, if point *a* is grounded, then phase A will be approximately 190 volt to ground.

Probably a better hook-up to supply the 220 volt lighting panel and also to use the 220/440 volt step-up transformers to supply a 440 volt 3-phase load would be to star or Y connect the secondaries of the lighting transformers and also the low voltage side of the 220/440 volt transformers. This assumes that the center tapped 100 kw. transformers may be connected so the secondaries are for 110 volt instead of 220 volt, and also the 220 volt side of the 15 kw. transformers can be connected for 220 or 110 volt operation. We would then have a connection something like that shown above. This hookup will give a lighting system that can be well balanced, also you can run 3 circuits (one from each phase) on one neutral. This may help to install a satisfactory job at less cost.—L.R.B.

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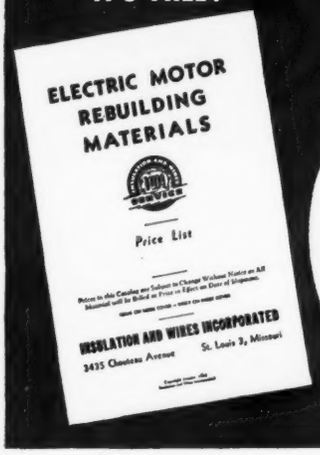

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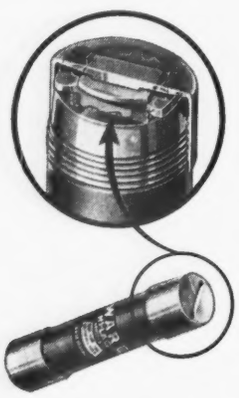

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Our ferrule type fuse has a heavy brass bar, which locks into open end ferrule, bridging fuse case. This bridge locks link to prevent twisting and cap tightens on new center contact. No sagging washers or twisted links to cause overheating.

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A. TO QUESTION 287 — The connection diagram shown in the sketch for the three 100-kw. transformers is incorrect. The error is that the midpoint of each secondary winding is shown grounded, which would place a three-phase short circuit on transformer bank. The voltage between these points is 110 volts, when there is none or only one ground connection made. When the transformer bank is also used to supply the usual type of lighting circuits, the circuits to the lighting panel should be taken from only one transformer and only the midpoint of that transformer grounded.—R.M.B.

Meter Testing

QUESTION 288—We have some kilowatt-hour meters that we desire to test for accuracy. Having no standard, is there any method without a large outlay of equipment or time (maximum 2 hours per meter) that can be used to accomplish this?—L.R.D.

A. TO QUESTION 288 — You did not state the rating of the meters, but I assume they are 5 amp. 115 volts.

If you can maintain a steady voltage of 115 volts, all you need is the following formula—a stop watch and you can adjust the meter within 1.5% accuracy.

Kh of the meter X 3600 X Rev. of meter = Watts Load

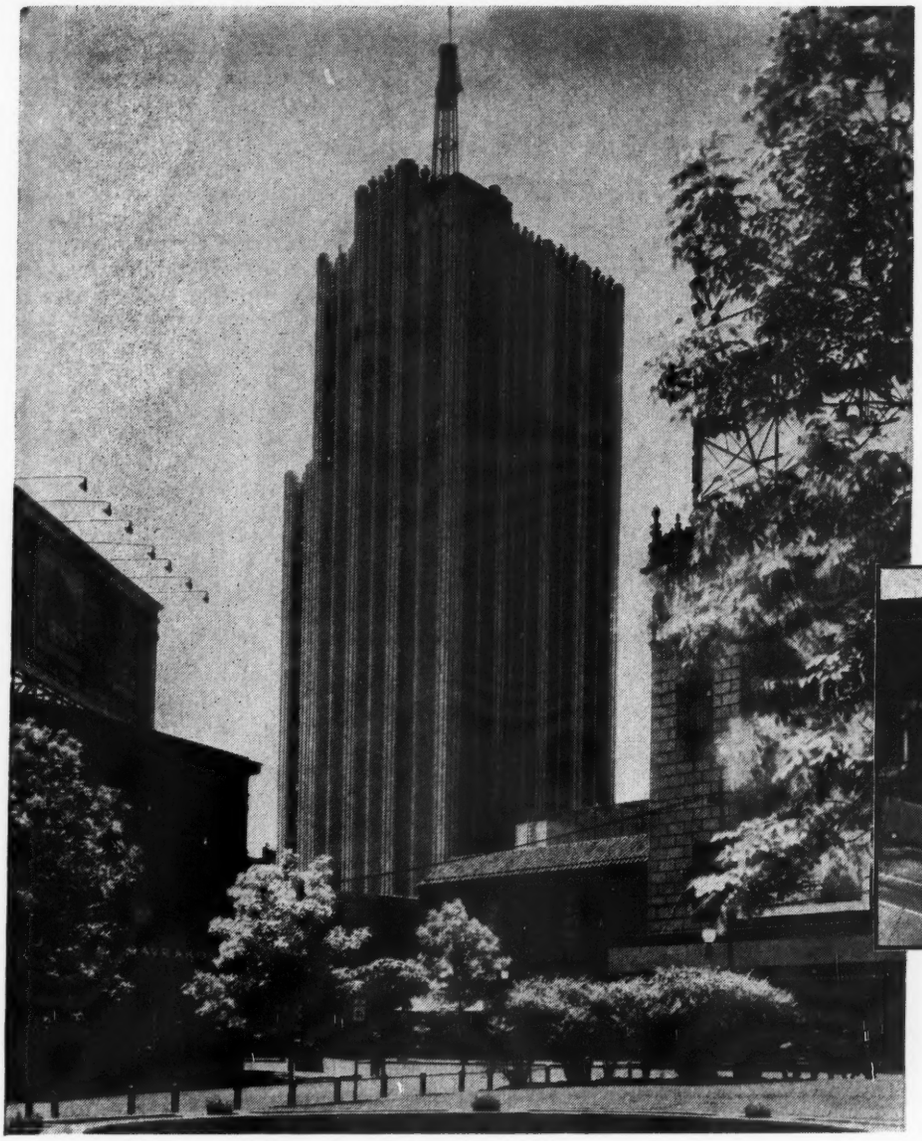
For light load on a 5 amp. 115 volt meter, use a 50 watt 115 volt light bulb and take 2 revolutions on the meter.

For heavy load, use a 200 watt 115 volt bulb and use 10 revolutions.

For a 10 amp. meter, double the above load but not the revolutions.—L.R.T.

A. TO QUESTION 288—L.D.C. does not give us very much information on his problem. The outlay of time and the cost of equipment will depend largely upon the rating of the meters which are to be tested. If they are low-current, low-voltage meters either alternating or direct current, his problem is very simple.

He can purchase a rotating standard, and by connecting the standard to measure the same energy which is passing through the meter under test, he can determine accuracy by a comparison of the revolutions of the meter under test and the full revolutions and fractions of a revolution of the stand-



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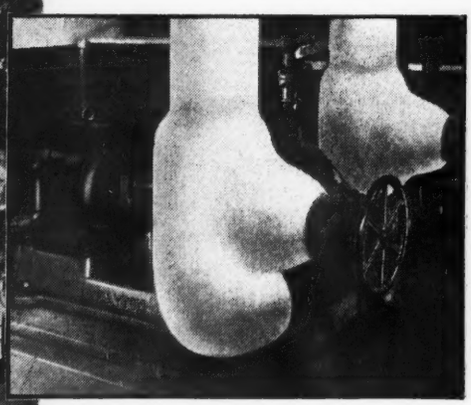
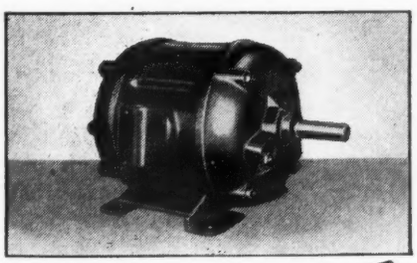


Pictured above is one of the 25-horsepower Wagner Polyphase Motors that drive the compressors in this system. Twenty-eight additional Wagner Motors are used in the complete installation.

Wagner Motors help keep it comfortable . . .

St. Louis' Continental Building boasts a roster of tenants that reads like "the Blue Book of American Business." One of the reasons why these leaders of industry have chosen this building to house their branch offices, is the fact that they realize how year 'round air conditioning increases employee efficiency.



The air conditioning engineers who installed the system in this building know that a modern "weather plant" can function properly only if it is equipped with dependable, efficient motors. That's why Wagner Quality Motors were chosen for this job, as they are for thousands of industrial, commercial and home applications.

Wagner Motors are famous for their sturdy dependability and efficient operation. If you use motors, it will pay you to investigate Wagner's complete line of motors for a wide range of applications. Users of Wagner Motors also profit by our quick, convenient, nation-wide service facilities.

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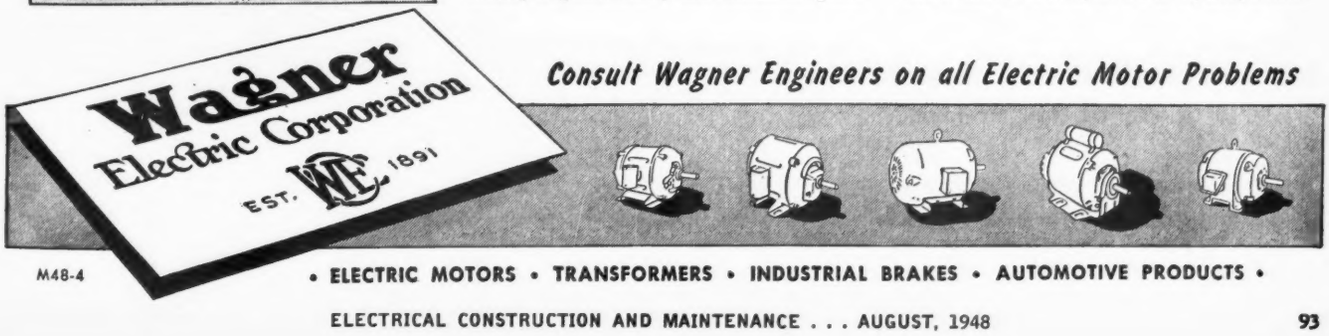

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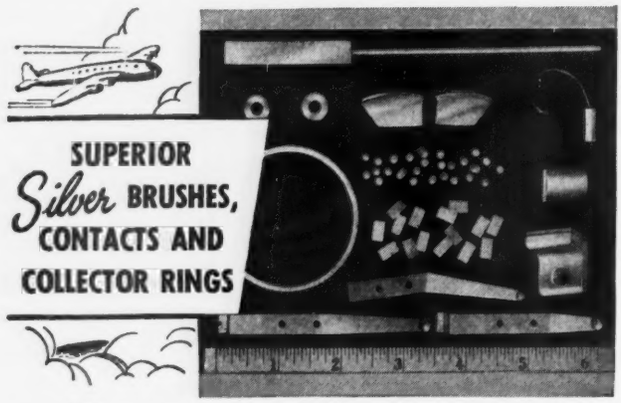

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ard. (These standards are portable and very accurate and the dial is divided into one hundred parts; each division is one one-hundredth of a revolution.)

With such equipment, a man should test an individual meter in less than forty-five minutes easily. This time would include jumpering the meter if necessary, making the necessary test connections, making adjustments and reconnecting the meter as found. By grouping of meters so that one set-up serves for a group the time per meter may be cut considerably.

He can also test his meters by means of a calibrated resistance or load box, a voltmeter and a stop watch. Time per meter will be approximately the same but not as accurate.

If the meters are of the larger sizes he may have to purchase batteries for direct current testing and transformers for alternating current testing in order to get voltages and currents which are safe for handling.

Polyphase meters are disconnected from the load and tested as single phase meters.—C.A.W.

A. TO QUESTION 288—A kilowatt-hour meter may be checked, by using a load of a known wattage, disconnect all of the load from the meter, a 200 watt lamp can be used when the lamp is connected, start counting the revolutions of the meter disk, and check the amount of time it is required to make a certain number of revolutions, then by using the following formula, the meter can be checked:

$$\frac{WHK \times 3600 \times R}{W} = \text{seconds}$$

WHK — the watt-hour constant marked on the meter disk.
3600 — number of seconds in an hour.
R — any chosen number of revolutions of the disk.
W — known load in watts which is connected to the meter.
Example:

$$\frac{.6 \times 3600 \times 5}{200} = 54$$

The answer 54 seconds, should be the same as the number of seconds, that is counted for 5 revolutions of the meter disk, if it takes longer time, it runs too slow, if it takes shorter time, it runs too fast.—C.W.D.

A. TO QUESTION 288—If you have one meter which you can rely on for accuracy, connect its current coils in series with those of the meter under test and connect the potential coils in parallel. Run a load test on this set up and compare the readings. You can test several meters at the same time with one standard if

it is possible to connect all potential coils to a common point, thereby eliminating the voltage drop across the current coils which would cause an error. All meters in the circuit must have the same current rating.—S.S.P.

Rotary Converters

QUESTION 289—In our substation we have 3 rotary converters connected through an equalizing bus to a common d-c bus. These converters are identical six-phase 250 volt machines. They are compound wound 200 kilowatt units. We recently installed a fourth machine in parallel with the original three. This fourth machine is a duplicate of the original three but is of recent manufacture. We find that this new machine will not share the load properly with the other three. If it takes its share of the load at low load, it hogs the load at higher loads. Why does this machine do this and what can we do to correct it?—W.P.R.

A. TO QUESTION 289—The fact that load division is not equal for all loads is due to the fact that there is some variation in the new machine or its connections.

I believe the most simple method of correcting this condition is to put a small resistance in series with the series field of the new machine. It would be best to arrange a temporary adjustable set-up until the correct value of resistance is determined. Assuming that the new machine takes its share of low loads, the resistance should be increased until it takes no more than its share at high loads. During these tests you will of course be watching the loads. It will be wise also for you to be prepared in the event the load on the new machine becomes unstable—or the series resistance is overheated.—C.P.S.

A. TO QUESTION 289—Use a shunt across the series field terminals to reduce the series field strength. It consists of a copper wire which is large enough to carry the load, and long enough to reduce the current at full load. Connect one side of the shunt at the equalizer and the other side at the other side of the series field to keep the voltage equal with hot field coils and cold field coils. —H.S.

A. TO QUESTION 289—Unfortunately, W. P. R. omitted to let E. C. & M. readers know if the rotary converters are connected

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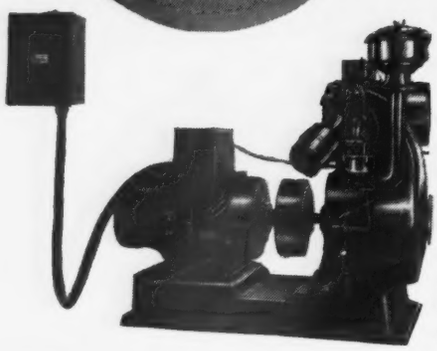

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through transformers. If so, check and recheck transformer connections. Furthermore, ascertain definitely that the d-c equalizing line is connected securely and properly. Last, but not least, it is quite possible that the fourth unit is operating inverted; that is, taking current from the d-c source, hence the hogging at presumably high load. Such condition he could easily ascertain through sequence operation of the units.—C.B.

Can you ANSWER these QUESTIONS

QUESTION M13— In giving 3 phase induction motors a no-load running test using a clamp ammeter it sometimes happens the readings show quite a difference, yet when the motor is connected to its load and another test is made with the same ammeter, the 3 phase readings are more nearly balanced or exactly so. This does not always happen, but I have noticed it more on 3 phase slip-ring induction motors. Why is this?—W.A.B.

QUESTION N13— We have a section in our plant that is particularly bad for burning out light bulbs. The voltage has been checked at various times and found to be within the specified voltage range of the lamps. This does not involve any one complete circuit but maybe just a couple of lights per circuit. Has anyone had any similar experience or could they suggest what might be the trouble?—F.F.

QUESTION P13 —We have watt-hour meters on individual feeders, in order to allocate energy costs to various departments. However, it would often times be an advantage to know the approximate energy requirements of a particular machine within a department, and I have in mind using a portable single phase watt-hour meter, together with split-core current transformer, and a 115 volt tap off a lighting circuit for potential. Assume the load to be a 600 hp., 2300 volt, 120 amp, 3 phase synchronous motor. The current transformer will be 200/5 amps. The watt-hour-demand meter is rated 100/5 amps, 2400/120 volts, 60 cycle, 2 wire, 1 phase. Kilowatt-hour multiplier is 100, and full scale on demand meter is 400 kw. Can this equipment be used for determining the approximate energy and demand requirement, and what multiplying factor should be used?—W.E.T.

PLEASE SEND IN YOUR ANSWERS BY SEPTEMBER 15

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Fiberglas-mica combination products are used as ground or slot insulations in motors and generators, phase insulations, transformer coil insulations, coil wrapping tapes, end insulations, cable splices—wherever mechanical and electrical requirements are severe and the maximum safety factor is desired.

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The Macallen Co., Boston, Mass.

Mica Insulator Co., Schenectady, N. Y.

National Electric Coil Co., Columbus, Ohio

New England Mica Co., Waltham, Mass.

5 Who Sells Them

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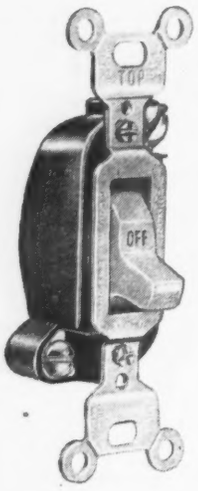
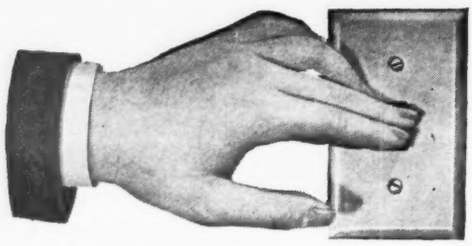


It's a 10-ampere, 125-volt, T-rated switch. This rating answers the demand made by today's heavy loads. The mercury switch is equal in interrupting capacity to the best specification-grade switches. And, it carries the Underwriters' Laboratories, Inc., approval — another indication of proved reliability and sound construction.



It has a silent, smooth action. Silent operation is an easily demonstrated plus value that makes it a natural for all modern wiring specifications. Because conventional blades have been eliminated, there is no contact click. A hermetically sealed "mercury-button" actuates the make-and-break at the flick of a finger.

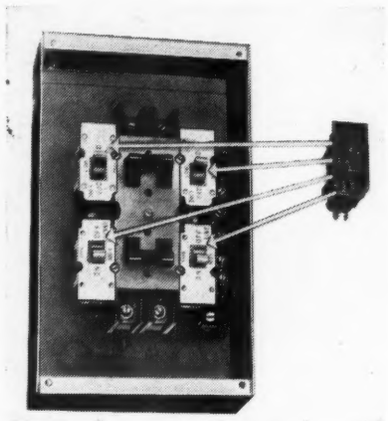
It will last for a long, long time. Because there are fewer moving parts to wear out, the mercury switch cuts switch maintenance. A newly designed, modern handle identifies the switch, and makes it possible to point to a specific feature of the wiring system that is modern—up-to-date.

It's part of the complete G-E wiring line. Everything you need for a wiring installation is available from the full General Electric line of wiring devices. When you plan your next electric installations, remember that the General Electric name on the products you install signifies long life and reliable service to every user. Customers know it is visible evidence of top quality on every job. Why not install General Electric wiring materials throughout, and let the best-known name in electricity go to work for you?

For information on this salesworthy line, see your General Electric merchandise distributor, or write to Section D22-818, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

Equipment News



Multi-Breaker

A new type, MB4, multi-breaker service and load center has been announced. Features are "Ad-on" units which permit circuits to be added or changed to satisfy new requirements; and high speed, thermal-magnetic (coilless) tripping. Unit consists of a double polarity, four pole basic unit with provisions to receive four more single pole "Ad-on" units. Multi-breaker can be used for direct switching of lighting and appliance circuits as well as to provide circuit protection. Single poles are calibrated 15, 20, and 30 amperes in accordance with NEC wire ratings. Double pole 40 and 50 ampere circuits have individual trip. A thermal element holds momentary overloads but trips if overload continues. Both flush and surface type enclosures are available. Square D Company, 6060 Rivard Street, Detroit 11, Mich.

Self-Powered Telephone

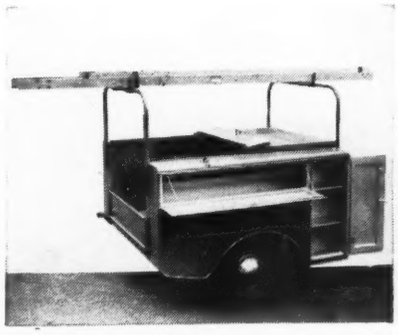
A new self-powered telephone with press-lever ringing signal has been announced. No batteries or other power connection are used for the telephone or bell ringer. To signal, remove handset, press ringing lever with finger and the bell rings at the "called" telephone. Ringing and voice communications are possible up to 20 miles. It is supplied as standard for two-station, pair phone operation. Through the use of a selector panel which can be furnished, telephones may be connected to provide one master station selectively ringing any one of a number of individual telephones; or a full selective ringing common talking system, each set consisting of a master station type of telephone capable of individual selective ringing any one of the telephones on the circuit. It is for office as well as plant installation. The Wheeler Insulated Wire Company, Inc., 150 East Aurora St., Waterbury 91, Conn.

Cable Ripper

The No. 9020 EZ cable ripper, is for stripping all types of non-metallic cable sheaths—braided or plastic. Designed particularly for use with the new, smaller diameter cables, it will also strip sheath from larger sized cables. It is composed of two hinged parts. In operation the end of the non-metallic sheathed cable to be stripped is laid in the rounded bottom channel. The hinged top is then closed over and firmly pushed down on the cable. This action forces a rudder-shaped ripper through the sheath. The ripper is pulled forward and the sheath is sliced. National Electric Products Corporation, Chamber of Commerce Building, Pittsburgh 19, Pa.

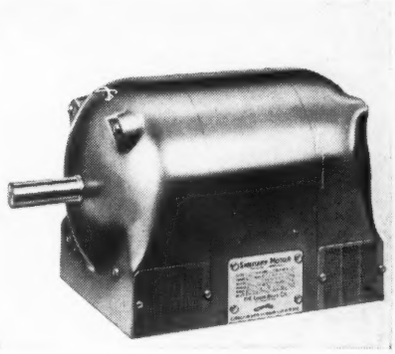
Selenium Rectifier

A new type "H" heavy duty selenium rectifier has been announced. Individual selenium elements measure 6¼ in. by 7¼ inches and are rated at 12 amperes (single phase bridge). Features are interlocking assemblies of rectifier components; conservatively rated terminals; special moisture-proofing. These assemblies are suitable for all applications requiring output in excess of 10 amperes. International Rectifier Corporation, 6809 South Victoria Ave., Los Angeles 43, Calif.



Workshop Trailer

This all purpose workshop trailer is designed for the type of work which requires the use of tools and materials to be carried to and from the job. Trailer can be attached to passenger car and taken to job site. All steel construction, with compartments on each side equipped with shelves and a tray, together with key locking door handles, providing an accessible, safe storage space for all tools required on the job. Trailers available in 75 inch and 90 inch lengths. Artisan Products, Inc., 3540 West 140th St., Cleveland 11, Ohio.



Motor

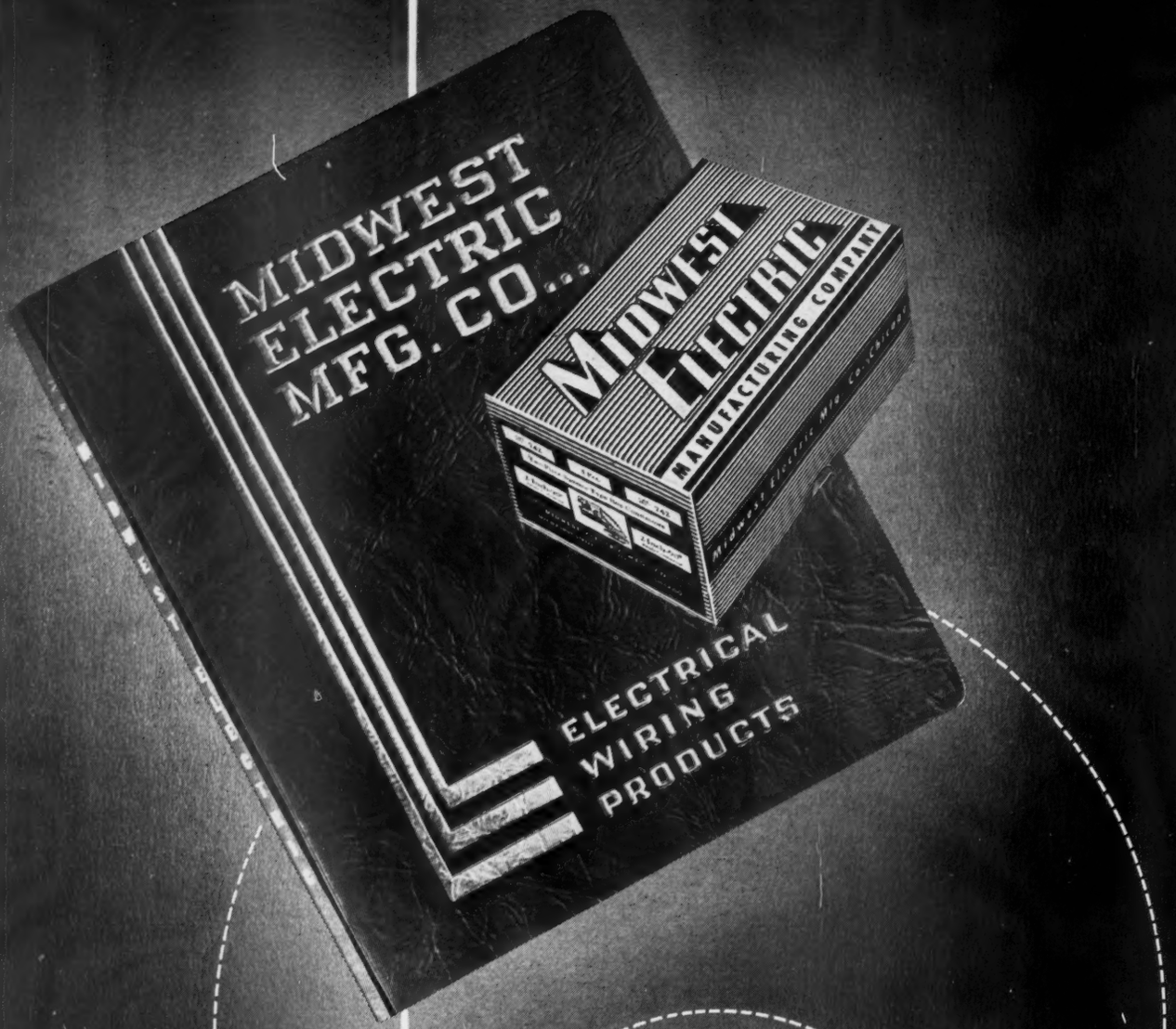
A sanitary motor for use in dairies, food process, canning and beverage plants has been developed. Unit is streamlined, and free of cracks, recesses or depressions where milk or food products can collect. Smaller ratings are supplied in totally enclosed, non-ventilated construction. Larger ratings are splash-proof and supplied with removable grille plates over cooling air inlets and outlets. Base is enclosed by motor housing which is finished to a flat surface. Mounting bolt holes are located in accordance with NEMA standards, permitting motor to be interchangeable with motors in use. Base design permits the use of a built-in conduit box. Conduit may be brought into motor through side or bottom of motor housing.

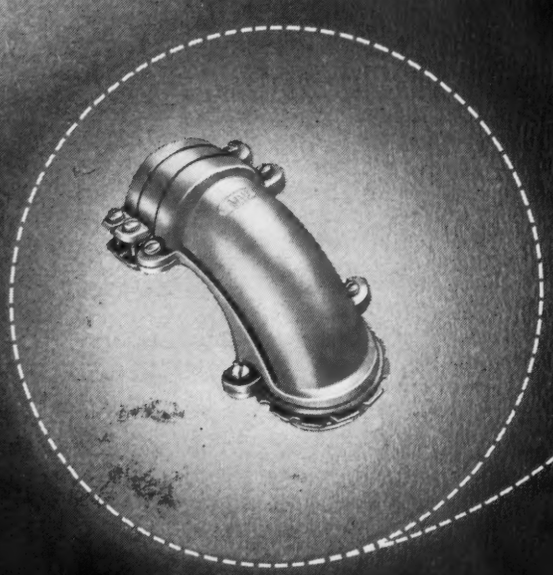
Door Chime

A two-tone door chime has been announced. It includes a special chime transformer and a matching pushbutton. Housing has a baked on ivory finish and a polished brass medallion in the center. Two one inch brushed and lacquered brass tubes sound two notes for the front door and one for the rear. It measures 41 in. long, 8 in. wide and 2½ in. deep. Liberty Bell Manufacturing Co., Minerva, Ohio.

Night Light

A one watt fluorescent glow lamp for night light service is available. The walnut size bulb is mounted in a plastic prong type base that plugs into any standard convenient outlet. It operates on 110-125 volts, a-c or d-c. Lamp is recommended for bedrooms, children's rooms, nurseries, halls, stairways and bathrooms. Its low wattage and long life make possible a full year's night and day service at a cost of less than 2½ cents a month for current. Westinghouse Electric Corp., Bloomfield, N. J.





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- thinwall conduit
- rigid conduit
- metallic and non-metallic cable
- flexible steel conduit
- service entrance cable
- grounding devices
- lighting fixture fittings

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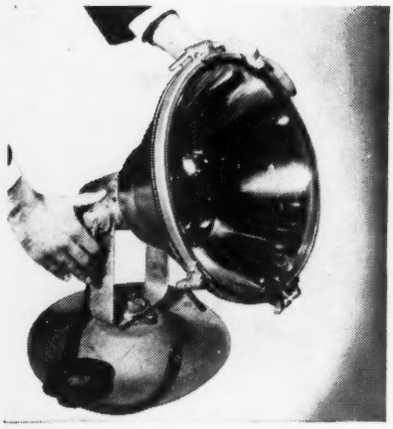


Floodlight

Two new general purpose floodlights designed for small area lighting have been announced. Type L-82 is rated at 300/500 watts and Type L-83 at 750/1000 watts. A sealed hinged door, which is locked by three clamping lugs, replaces the clamped ring on older types. Unit has an aluminum reflector and a locking handle on elevation adjustment. Both units can be provided with a portable base as well as slip fitter and pipe clamp mountings. Base measures 14⅛ inches in diameter. General Electric Company, Schenectady 5, N. Y.

Electrical Wire

A new small diameter electrical wire, known as Neolay, Type RU, has been developed for wiring homes, offices, factories, hotels and other buildings. Nylon forms a hard shell over the rubber insulation, giving the conductors better protection. It is 30 percent smaller in diameter than conventional building wire. Under the nylon are two layers of insulation—natural rubber and neoprene synthetic rubber. Nylon is hot and liquid when applied over the rubber. The new wire is claimed to be resistant to gasoline, oil, fire, moisture, acids and light. Available in sizes 14, 12, 10, 8 and 6. United States Rubber Company, Rockefeller Center, New York, N. Y.

Instrument

A new instrument for testing all electrical circuits and appliances has been introduced. It is for use by electrical contractors, maintenance men, motor repairmen, appliance repairmen and others. Instrument measures actual current consumption of any appliance or utility, either a-c or d-c, and will measure it while unit is in operation. Reading is direct in amperes. It incorporates an ultra-sensitive direct-reading resistance range. Known as the Utility Tester, it tests all electrical appliances and motors up to two hp. General Electronic Distributing Co., 98 Park Place, New York 7, N. Y.

Induction Motor

A new wound-rotor Life-Line induction motor, Type CWP, of open drip-proof construction is available in ratings of 1 to 15 hp. (Frames 203 through 326). Brushes are made of electro-graphite or metal graphite. Brushholders are of the sliding box type with adjustable spring tension. Rotor core consists of punchings riveted into solid structure and held on shaft by shrink fit. Motors may be used wherever adjustable speed is required, or where high-starting torque with low starting current is necessary. Useful for driving compressors, plunger pumps, positive pressure blowers, or for bringing heavy loads up to speed. Available for 60, 50 and 25 cycle, two and three phase, 208, 220, 440 and 550 volts. Type P base for vertical mounting and several types of flanges or brackets available for horizontal mounting. Westinghouse Electric Corp., Pittsburgh 30, Pa.

Switch

A new Bakelite flush toggle switch with luminous toggle has been announced. It carries Underwriters' approval and is "T" rated. It has large head 8/32 in. wire screws that are staked to allow easy and quick wiring. Wide ears measuring 1 inch facilitates easy installation in new work. Plaster ears can be removed when desired. Available in brown and ivory. Rating is 10 amp. 125 volt; 5 amp. 250 volt. Eagle Electric Manufacturing Company, Inc., 23-10 Bridge Plaza South Long Island City 1, N. Y.

Stapling Gun

An automatic stapling gun for stapling all wire, with a controlled power chamber to meet any predetermined drive without marring or injuring the wire, has been announced. It staples braided, rubber coated, single and double strand wire and hollow tube lines to baseboards, plaster walls, window frames, door jambs, rafters and around angles or corners. Staple drives in hard or soft woods. The Heller Company, 2153-E Superior Avenue, Cleveland 14, Ohio

Pump

A new electrically driven hydraulic pump, known as P-182 Porto-Power, has been announced. It is self-contained and operates all porto-power rams. It operates on 110 volt, 60 cycle a-c. It can also be connected for 220 volt a-c. It has a vertical motor with flange mounting; ½ hp., 1725 rpm., single phase, high torque, repulsion start, induction run. It is equipped with 8 foot, 3 wire, cord and two prong plug with ground pigtail, toggle switch mounted on base. Blackhawk Mfg. Co., Milwaukee 1, Wis.

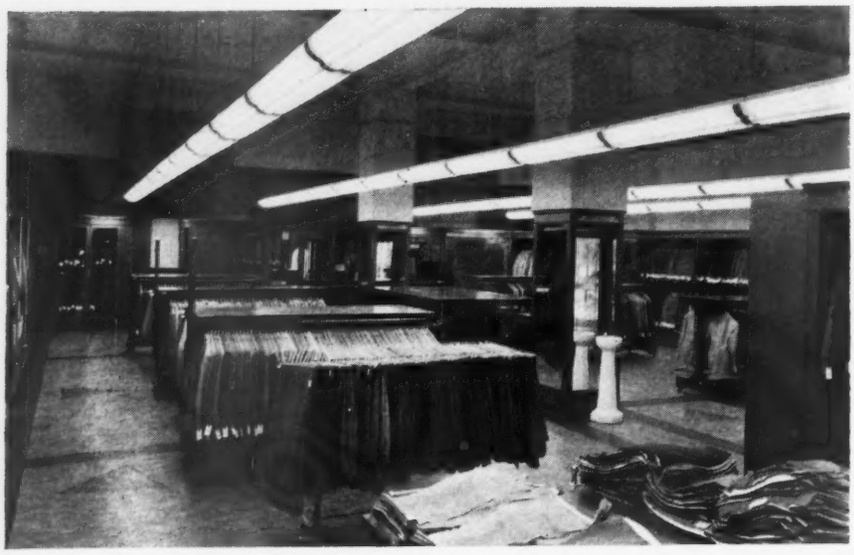
Varnish

A new insulating varnish, designated as No. 9574, has been announced. It can be used with practically all types of winding including enamel, cotton, asbestos, and glass covered wire. A thermosetting, phenolic drying-oil varnish, it cures to a tough, pliable mass and gives resistance to oil, acid, alkali, salt water, moisture and heat, and is suitable for infrared baking. The varnish is especially easy to work and can be cured in conventional equipment at baking cycles as low as 212 F. It has a flash point of 100 F and its viscosity at 45 F is 600 C. P. average. It can be used at barrel gravity or can be thinned up to 20 percent with petroleum spirits or a commercial thinner. General Electric Co., Schenectady, N. Y.

Fans

Four new fans have been added to this line. (1) All purpose, 30 inch cooler fan. It may be mounted on attic walls or installed in either upper or lower portion of double hung windows. It may also be used in offices, shops and stores. (2) Commercial and industrial a-c air circulators in 24 and 30 inch sizes with four styles of mounting accessories including floor column, counter column, ceiling and wall bracket. (3) A 16 inch cooler fan for window installation in small apartments, several rooms of a home, small stores, shops. (4) A 10 inch kitchen ventilating fan for built-in ceiling mounting. Emerson Electric Mfg. Co., St. Louis, Mo.

NOW, OFFER YOUR CUSTOMERS MODERNIZATION WITHOUT REDECORATION



Above, an installation of KAYLINE "SUNLITE" Units, illustrating how use of these famous fixtures achieves the effect of modernization without expensive alterations . . . a big selling point for your customers!

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CLUB ROOMS
PUBLIC BUILDINGS
HOTELS
THEATRES
INSTITUTIONS
RECREATION ROOMS

The KAYLINE "SUNLITE" Unit shown in the installation above features Corning Alba-Lite Panels releasing more light in every direction. "SUNLITE" units are easy to install, and easy to service. The striking design blends with any architecture and units can be used singly or in continuous runs.

A really complete selection of flourescent fixtures is available in the "KAYLINE"—residential, commercial and industrial. Check your lighting interest on the coupon below and send it to us today!

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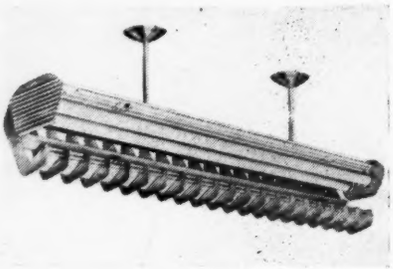
☐ KAYLINE Troffer Lighting Fixtures

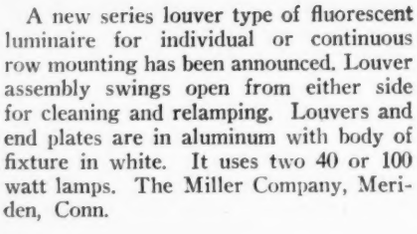
Fluorescent Lamp

A new 75 watt T12 slimline fluorescent lamp has been announced. The lamp is 1½ inches in diameter, and 96 inches long. Available in warmtone color, 3500° standard white and 4500° white. It is instant-starting, has a single contact base and contains a special hydrophobic coating. It exceeds an average of 600 lumens. Long life and better maintenance characteristics are claimed for this new Slimline lamp. Sylvania Electric Products, Inc., New York, N. Y.



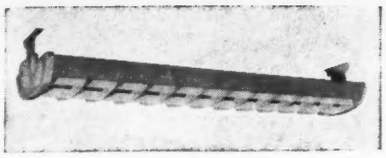
Fluorescent Fixture

A new series louver type of fluorescent luminaire for individual or continuous row mounting has been announced. Louver assembly swings open from either side for cleaning and relamping. Louvers and end plates are in aluminum with body of fixture in white. It uses two 40 or 100 watt lamps. The Miller Company, Meriden, Conn.



Loom Motor

A new totally enclosed Tri-Clad loom motor specially designed to meet the requirements of loom operation has been announced. Covering the entire range of 2 hp., 1800 rpm. and smaller, all ratings are built in a single frame diameter with two axial lengths. All ratings are available for foot mounting or for three-arm suspension. Motor has more conveniently located oil fittings and a new design wool-packed, steel-backed bronze sleeve bearing. An oil-resistant multi-conductor jacketed cable is furnished. The shorter length of motor permits a saving in aisle space. General Electric Company, Schenectady, N. Y.



Fluorescent Fixture

A two lamp fluorescent light type CD-80 for school or office use has been announced. Available as a direct-indirect type with steel louvered bottom or as a semi-indirect type with translucent plastic bottom. Unit is shielded and provides maximum diffusion with low brightness. Plastic side and bottom panels are polystyrene extrusions. Two positive acting lock springs located at the ends of the luminaire can be released by finger action permitting removal of plastic. Single and twin stem hangers are available for suspension mounting. Louvered units can be mounted on ceiling brackets when required. Starters and ballasts are accessible without removing the lamps. Westinghouse Electric Corp., Pittsburgh 30,

New Equipment Briefs

A new protable hydraulic pulley **puller** for use in electric motor service shops and industrial maintenance departments. It is manufactured by Industrial Engineering Equipment Co., Davenport, Iowa. . . . Delta-Star Electric Company, Chicago, Ill., has announced a new vertical break air **switch,** known as "MK-40". . . . A new Vulco heating and **brazing torch** is being marketed by Furlo Sales Company, Los Angeles, Calif.

Raytheon Manufacturing Company, Waltham, Mass., has announced the introduction of the new VR-6000 line of catalog and custom-engineered automatic voltage **stabilizers** for a-c line voltage stabilization. . . . Announcement has been made of the development of a surface Type Q1 **indicating lamp** by H. R. Kirkland Co. of Morristown, N. J. . . . Tomhar Manufacturing Co., St Louis has announced several new **tools,** and equipment items, undercutter, hand taper, coil tampers, paper turners, wire scraper and varnish cup.

A new line of plastic shielded **fluorescent fixtures** has been designed for home use. Shields are manufactured by United States Rubber Co. and the lighting fixtures are made by Markstone Manufacturing Company of Chicago. . . . H. R. Basford Company, San Francisco, Calif., has announced a new **vise plier** called "Gripso." It has fingertip release, double-acting adjustment screw and new-type jaws. . . . The American Controller Company, Chicago, announces the development of a pneumatic timing **relay** for use in elevator and other industrial control applications where a delayed circuit is required after energization or de-energization for operations performed in time sequence.

[Continued on page 150]

FLOODLIGHTS *in a hurry—*

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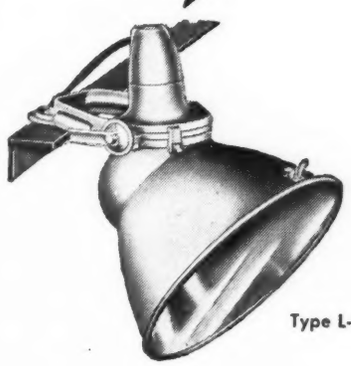
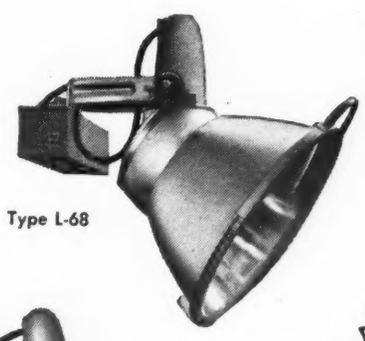


Type L-69

For sports and area lighting

TYPE L-69—the high efficiency unit used for Yankee Stadium, Fenway Park, Briggs Stadium. Spun-sealed, enclosed. 1000/1500 Watts. Medium and Wide Beam.

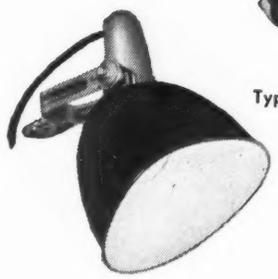
TYPE L-68, similar to L-69 with slide-type glass door, Alzak* Processed Aluminum. 1000/1500 Watts.



Type L-68

For low-cost area lighting

TYPE L-45 open unit. Wide beam, porcelain enamel. 300/1500 watts. Available with auxiliary internal reflector for longer range projection.



Type L-45

FOR MORE INFORMATION, phone your nearest G-E agent, or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.

**Manufactured under Aluminum Company of America patents.*

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ALL STAR CAST

of treated and untreated electrical insulations

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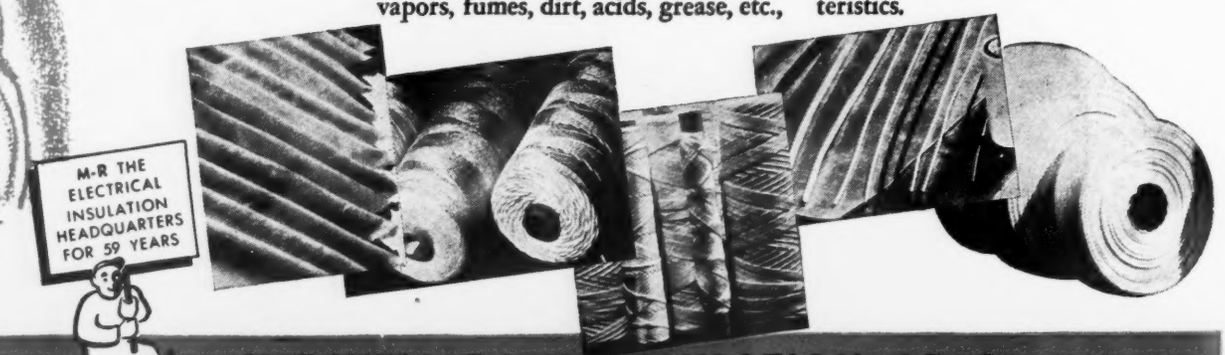
YES, MIRAGLAS ELECTRICAL INSULATIONS have what it takes to stand up and resist the destructive forces that play havoc with ordinary electrical insulations.

YES, MIRAGLAS ELECTRICAL INSULATIONS add life to electrical equipment; overloading, extreme high or low temperatures, moisture, corrosive vapors, fumes, dirt, acids, grease, etc., have little effect upon electrical apparatus protected by MIRAGLAS ELECTRICAL INSULATIONS.

YES, it will be worth your while to take note of MIRAGLAS ELECTRICAL INSULATIONS . . . they stand for the ultimate in electrical insulations woven of Fiberglas yarn . . . write today for their details and characteristics.



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Motor Shops

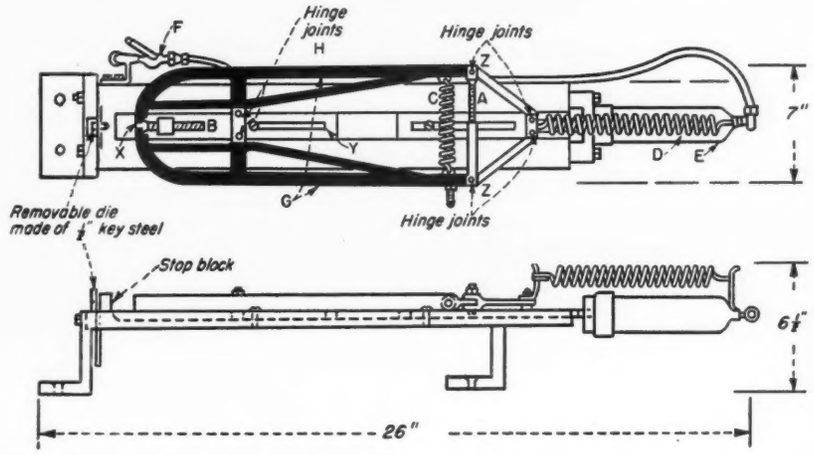


Fig. 1—Diagram of mechanism with parts identified to illustrate its operation (see text).

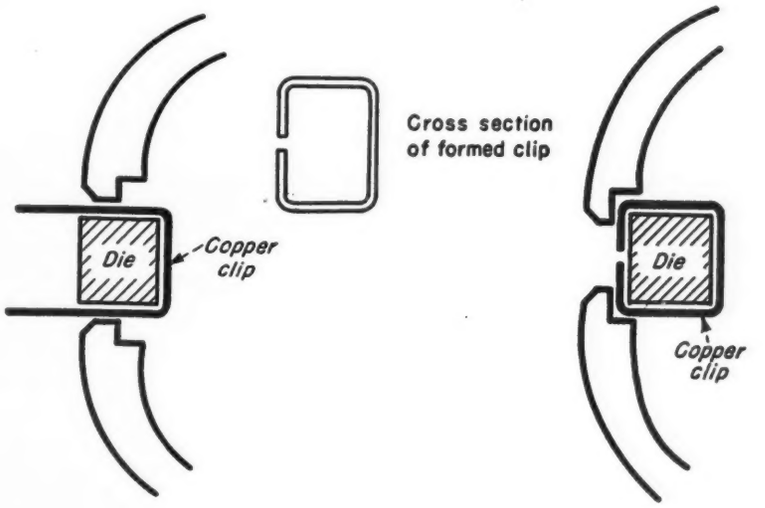
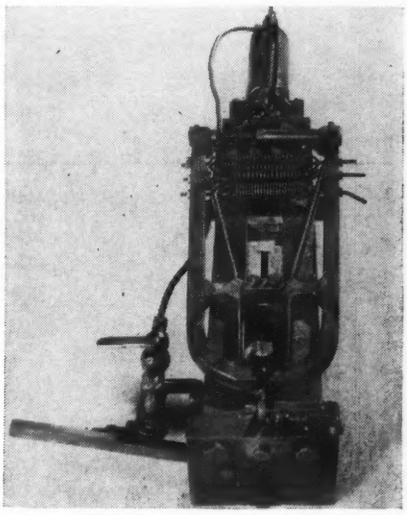

Cross section of formed clip
Die
Copper clip
Die
Copper clip
Step 1:
Forming arms move forward bending copper strip into U-shape and stop when jaw offset reaches end of die plus thickness of strip
Step 2:
Continuous pressure of air cylinder causes forming arms to close around die and bend back ears of clip

Fig. 2—Diagram illustrating the two forming steps machine accomplishes in a single operation.

Pneumatic Device For Making Copper Clips

Cross and stub connections on alternating current stators are usually made with copper clips. Forming these by hand always has been a problem of motor repair shops. There was no assurance of uniformity and it was a time-consuming chore. That was the situation at the Giles Armature & Electric Works, Inc., Marion, Illinois, until they designed and built an air-operated machine to turn them out in quantity. It formerly took from three to four hours to make a set of 90 clips by hand. With the new machine, a mechanic can turn out a set in less than 30 minutes, including time for making the die, cutting the strip copper and forming the clips.



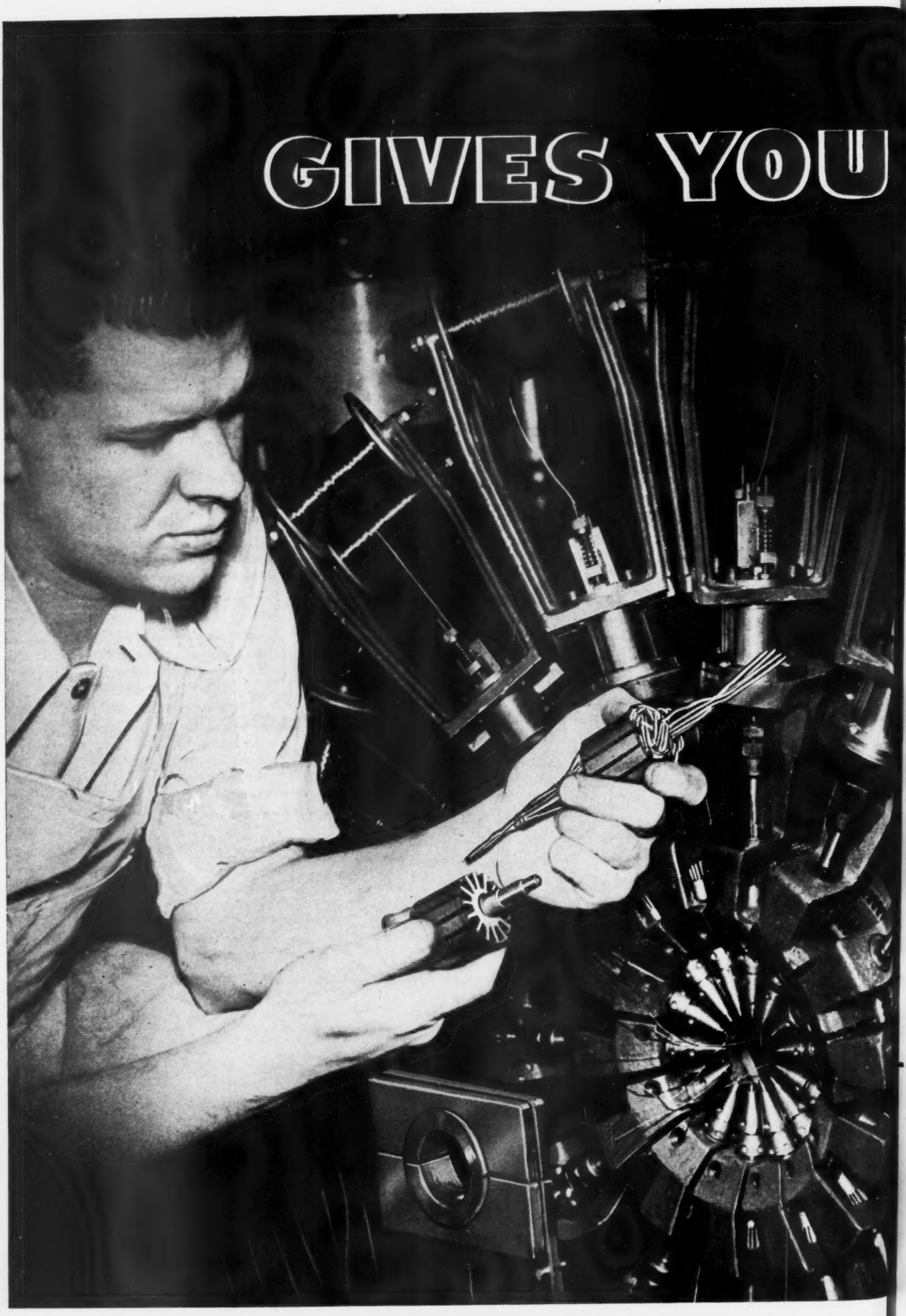
Adjustable air-operated machine that forms copper clips for making stub and cross connections on a-c stators.

Entered in the 1947 NISA Award Contest by John R. Barham of the Giles shop, this device took second prize. Details were released for publication through the courtesy of the 1947 NISA Award Committee.

The machine takes little bench space; is only 26-inches long, 7-inches wide and 6½-inches high. The unit consists essentially of two pivot-cantilever type forming arms with a rod linkage mounted to two metal slides that ride in the milled groove of a metal base. The arms are moved forward by a compressed air cylinder; returned to original position by spring action.

The two forming arms "G" (see Fig. 1) pivot around hinged joints "H" that mount them to slide "Y". The base of each arm is hinged at "Z" to a linkage attached to the cylinder piston and a second slide. Compression spring "C" operating against adjusting bolt "A" keeps the arms rigid until displaced in the final forming step by action of the air cylinder "E" and adjusting screw "B".

Easiest way to understand the operation of this device is to study the diagram in Fig. 1 and follow the few steps required to form a clip. The die is cut from ½-inch key stock to required measurements. Forming arms "G" are set by moving the nut on the adjusting screw "A" so that the opening "X" at the jaws of the arms will be wide enough to clear the die plus twice the thickness of the copper strip. Length of stroke is controlled by setting adjusting screw "B" which stops slide "Y".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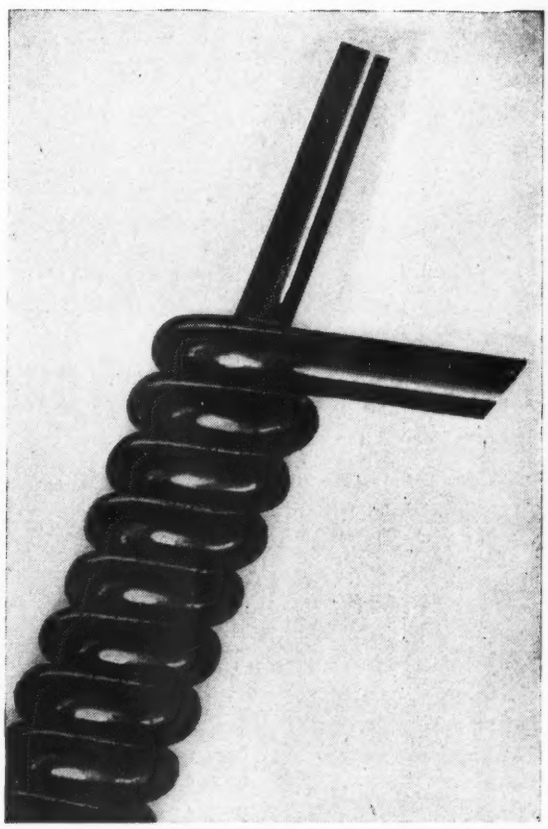
A 3 TO 1 ADVANTAGE

TRY ITS ABRASION RESISTANCE, to learn how tough an insulation is. Roevar Magnet Wire shows a three-to-one advantage over standard enameled wires. And such superiority makes Roevar wire your first choice for high-speed winding operations.

Besides its strength and toughness, Roevar Magnet Wire insulation has high dielectric qualities, is extremely flexible, and has exceptional resistance to solvents used in coil-treating varnishes. Importantly, too, Roevar Wire costs less and is of smaller diameter than magnet wire with paper, cotton or silk insulation. It is furnished in sizes No. 14 to 40 A.W.G.

Roebling engineers are anxious to cooperate with you, in helping determine where Roevar Magnet Wire can be used most effectively and to assure best results. Write for full information and samples of the wire.



Test shows Roevar Magnet Wire (magnified) wrapped on its own diameter, without appreciable loss in dielectric strength.

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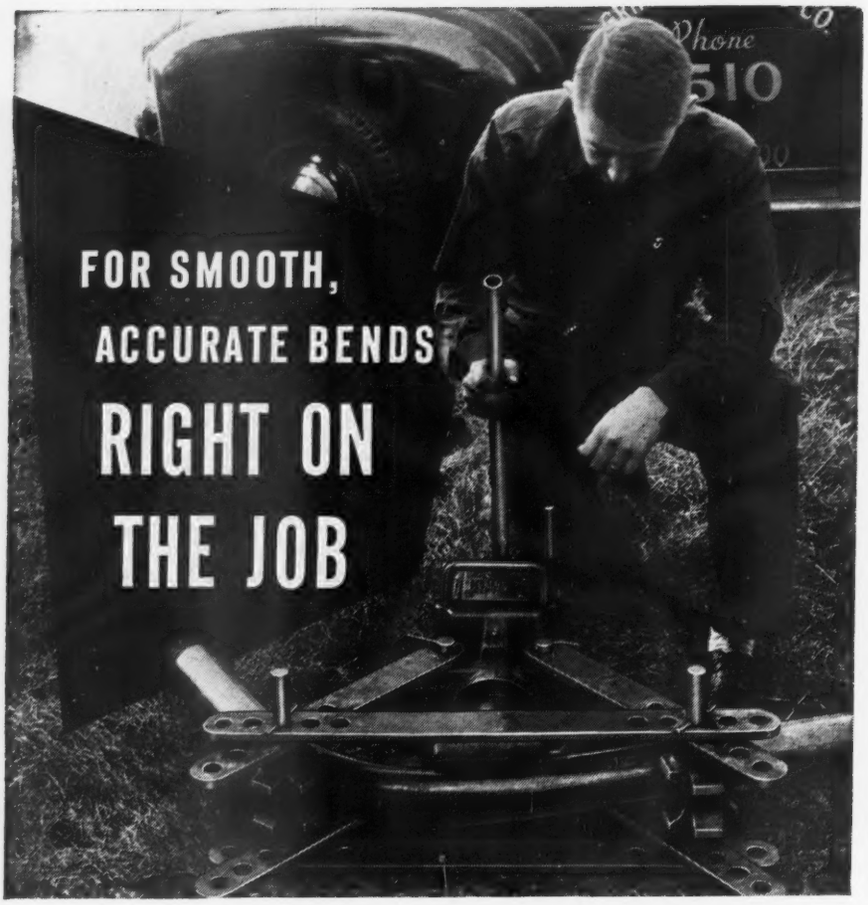

GREENLEE HYDRAULIC BENDER

Whatever the job location, the portable GREENLEE Hydraulic Bender can be taken *right to the spot* where the work is to be done.

Bends are quickly made exactly where and when wanted . . . tailored to the exact requirements of the installation. For example the GREENLEE Bender owned by the Griffin Electric Company of Owensboro, Kentucky, is shown above on job location where it was used to bend various sizes of conduit from ½" to 4½".

"Where promptness and swiftness are the main factors on a job, the GREENLEE is always used to save time and materials and eliminate need for manufactured fittings," reports this company.

With the GREENLEE, *one man* quickly makes smooth, precise bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. This means as high as 75% labor savings, many owners report, with material spoilage reduced to practically nothing.

Get facts today on the timesaving GREENLEE Hydraulic Bender which often pays for itself on the first few jobs. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1748 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

Stroke travel is set so that the inside point at "X" (offset in jaws) just passes the die plus the thickness of the copper to be formed.

Copper strips are cut to correct length by measuring the four sides of the die (total length equals the sum of the four sides). The copper is then placed in position between the die and the stop block and centered on the die by means of an adjustable gauge.

The first forming step takes place when the air valve "F" is opened. As the air cylinder plunger pushes the forming arms forward, the copper is bent into a U-shape about the die (Step 1, Fig. 2). This forward movement continues until the adjusting screw "B" stops the slide "Y".

The second and final forming step then follows. Since the arms can no longer move forward, the pressure of the air plunger forces the arms apart at hinged joints "Z" (adjusting screw "A" has a slip fit in tubular end). This action causes each arm to pivot about hinge joints "H" in cantilever fashion; forces the jaws to come together around the die and bend back the ears of the U-shaped clip (Step 2, Fig. 2).

Closing air valve "F" bleeds cylinder "E" releasing pressure on the linkage at "Z" and slide "Y". Spring "C" opens the jaws of the forming arms and spring "D", above the air cylinder, returns the mechanism to its original position. An ejector removes the clips from the die.

This is the first unit built in the Giles shop. It works so well that plans are under way to refine it by incorporating a double action air cylinder with a four-way, foot-operated air valve. Additional adjustments are also being made on the forming arms so that rotor clips may be made on the same machine.

Tracings File

Original tracings containing shop drawings, construction details, wiring plans and diagrams are filed in a specially-constructed filing cabinet by the Davidson Electric Company of Brooklyn, New York. All tracings for a specific job are rolled on a single wooden roller, one end of which is capped by a disc of galvanized steel, center-drilled to permit passage of a standard wood screw which fastens the disc to the end of the roller. The disc is slightly larger than the outside diameter of a standard cardboard mailing tube. With tracings smoothly wrapped around the roller, the assembly is slipped into a mailing tube. Tracings are thus protected against dust, dirt and damage while the disc prevents the roller and tracings from dropping from reach or from sight inside the tube.

WHY THE *Experts* PREFER FEDERAL NOARK BUS DUCT

DESIGNING ENGINEER-ARCHITECT

"I *like* to lay-out Federal NOARK Bus Duct! I can draw up the standardized units as soon as the plant layout is established. And, because there's a plug-in receptacle on either side—on one-foot centers—I don't have to worry about the exact position of every machine and motor."

INSTALLING ELECTRICAL CONTRACTOR

"Installing Federal NOARK Bus Duct makes my organization look good! Every unit lines up perfectly—drop hangers slide in position for exact alignment . . . and we don't have to worry about ceiling or wall conditions. The job is tops for speed, too—so it frees my crew for other profitable jobs!"

MAINTENANCE ELECTRICIAN

"My boys are in favor of Federal NOARK Bus Duct *safety*—and so am I! When you're standing on a fourteen-foot ladder, you're glad that the plug-in receptacles are *insulated*. And, when there's lots of machines to 'hook-up' it's a great help to have a Bus Duct you can get at from *either* side."

TOP MANAGEMENT

"We like the production figures we find wherever Federal NOARK Bus Duct is installed. *Uninterrupted production*—with no shut-downs for maintenance or relocation of machines—is a great thing these days! And, if we ever move our plant or departments—we'll be glad that Federal NOARK Bus Duct is completely salvageable!"

Write for Bus Duct Catalog
"It stays on the job!"

Executive Offices: 50 Paris Street, Newark, N. J.
Plants: Hartford, Conn. • Long Island City, N. Y.
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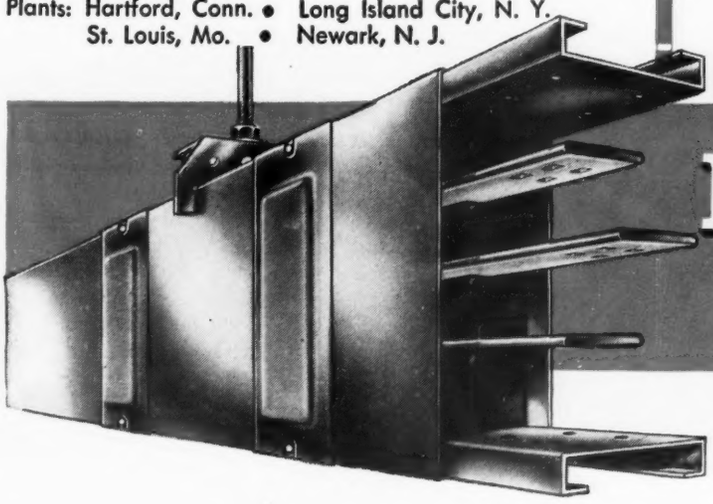
FLEXIBLE, ECONOMICAL, EFFICIENT, SAFE—that's why so many top designers, technical men, and executives who have seen Federal NOARK Bus Duct in action in major industrial plants rely upon it to solve all secondary power distribution problems. And that's why you'll be in favor of Federal NOARK Bus Duct, too!



Federal NOARK Bus Duct

Federal Electric Products Company, Manufacturers of a Complete Line of Electrical Products, including Motor Controls • Safety Switches • Service Equipment • Circuit Breakers • Panelboards • Switchboards • Bus Duct

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PANTHER and DRAGON Friction Tapes work easily. Splices stay tight in cold as well as warm weather. Sold only through recognized independent wholesalers. The Okonite Company, Passaic, New Jersey.

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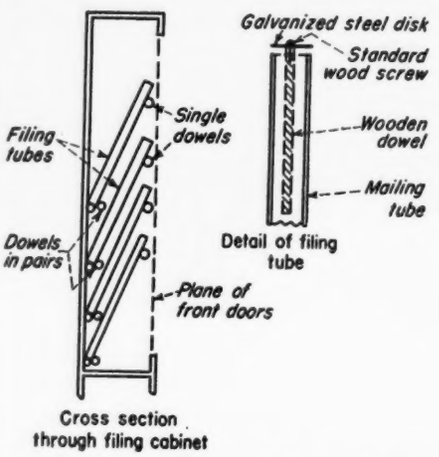
Panther and Dragon
friction and rubber tapes

E. S. Davidson removes a filing tube from the tracing cabinet located in the drafting room of the Davidson Electric Company, Brooklyn, N. Y. Tracings, rolled on shafts fitted with galvanized steel discs, are kept in excellent condition and are readily located for reference or reproduction.



Single dowels are placed across front of cabinet on approximate 9-inch centers while dowels are placed in pairs at rear of cabinet. Dowels are held in position by fastening them to strips of plywood running vertically along both side interiors. Tubes are supported by lower dowels and rest against the upper, front ones. Tracings are rolled on shafts, fitted with end caps, and are kept in standard mailing tubes for storage.

Tracings can readily be located by means of either a number placed on the disc or by a small label fixed around the lip of the mailing tube.

For storing these tubes, a standard steel filing cabinet was fitted with several tiers of $\frac{3}{4}$-inch wooden dowels, a single series of dowels placed at the front of the cabinet on 9-inch horizontal centers, and dowels in pairs positioned at the rear of the cabinet and spaced the same distance apart. Dowels are held in position by means of plywood strips running vertically at either side of the cabinet. When storing the

RAINTITE PROTECTION For Outdoor Installations

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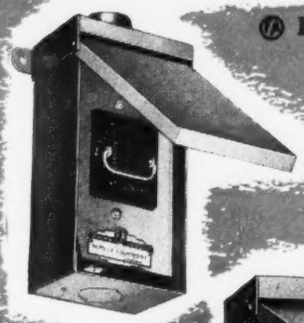
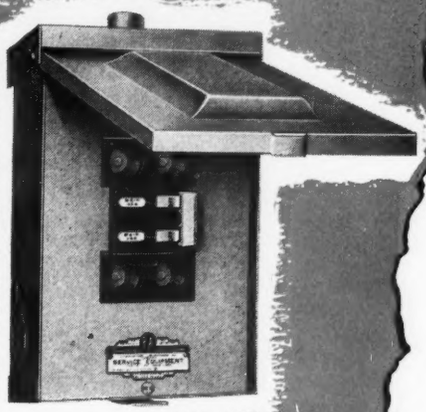
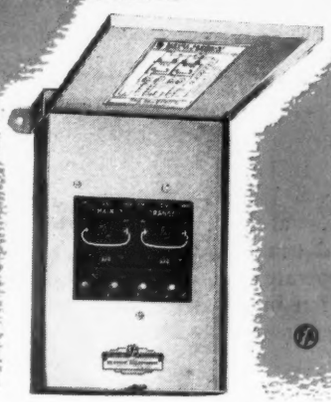


Ⓕ SEPF



Ⓕ SE50B3



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offers ideal weatherproof protection for electrical installations that can't come in out of the rain... such as lighting systems for billboards, parking lots, playgrounds, electric signs, etc.... and other outdoor installations, for stores, building projects, homes and farms.

These raintite, rustproof units provide the safety features and electrical capacity expected of indoor installations and conform to the recommendations and requirements of Underwriters' Laboratories, Inc., as well as utilities throughout the nation.

Typical of Ⓕ Service Equipment, there's a raintite unit of every type . . . the Ⓕ Load Center for *automatic* circuit protection, featuring the popular Ⓕ Thermag Circuit Breaker; the Ⓕ SEPF fuse-protected service equipment with safety-type Ⓕ Pul-fuzswitches (commonly called "Pole Switches"); the Ⓕ SE50B3 unit with main breakers and plug fuse branches; and the Ⓕ SEMR Main and Range Unit.

FOR MORE INFORMATION about any of these raintite units, consult your nearest Ⓕ Representative (he's listed in Sweet's) or write for our Service Equipment Bulletins No. 76 and 202.

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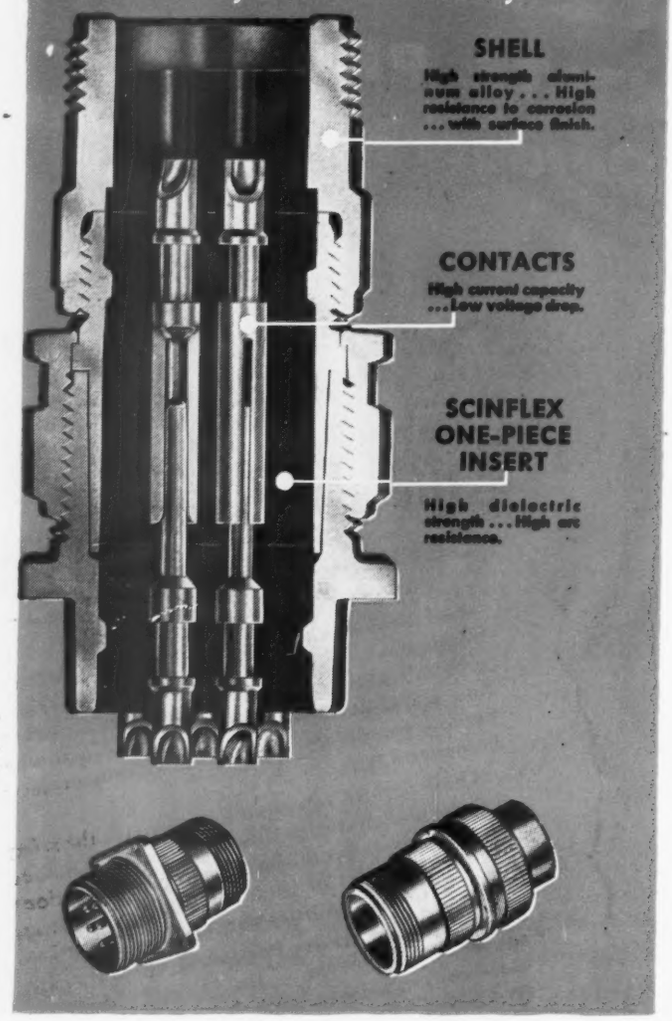
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Available in all Standard A.N. Contact Configurations

BENDIX SCINTILLA — SCINTILLA MAGNETO DIVISION OF SIDNEY, N. Y. — AVIATION CORPORATION

tubes, the containers are inserted into the cabinet on an incline with the upper or capped end of the tube resting against the single dowels and the bottom or open end of the mailing tube supported by the dowels arranged in pairs.

Little space is necessary to install the cabinet, drawings are kept in excellent condition and the desired tracing can be located rapidly and with minimum disturbance to other drawings.

While tracings are rolled, all blueprints on file are folded. This has been found more satisfactory for, with blueprints folded to file size, a single sheet can be withdrawn without having to remove an entire set of prints. All blueprints pertaining to a specific job are filed together in a cabinet adjacent to the one holding the rolled original tracings.

Both cabinets are located in Davidson's modern drafting room where planned lighting, acoustical ceilings, the latest equipment for reproducing prints, and modern drafting aids are installed. Located on the second-floor level, adjacent to a high-bay shop area, the drafting room contains a large sliding glass panel which can be rolled back when overall supervision is required in the shop below.

Single Control Operates Spray Booth

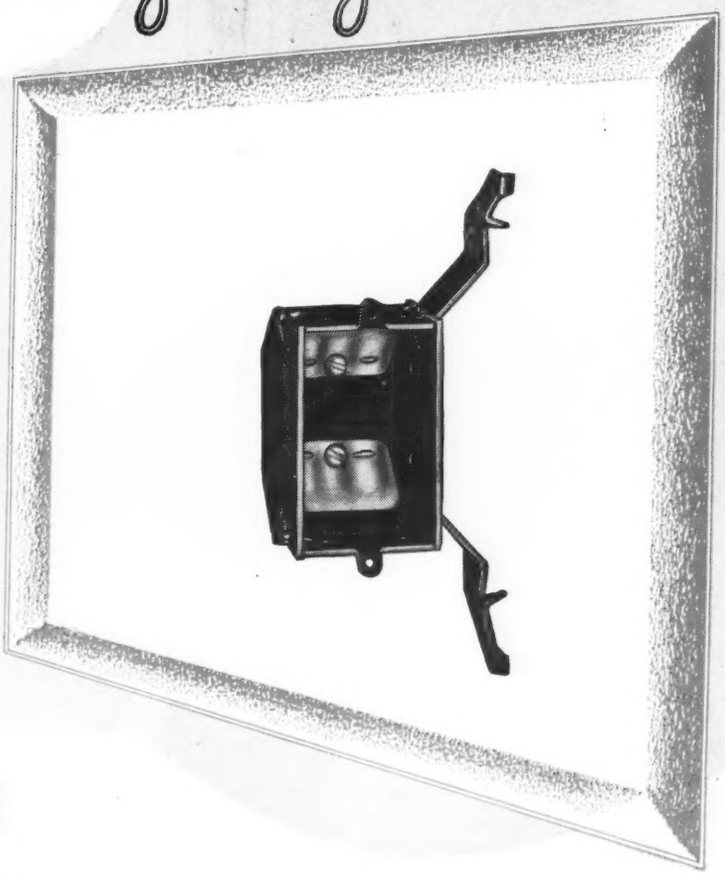
The importance of safety in motor shop operation cannot be overemphasized. Volatile liquids in the form of insulating varnishes, cleaning compounds and paints are in constant use. Adequate ventilating facilities are a must item in shop design.

The management of the Koontz-Wagner Electric Company, South Bend, Indiana, leaves nothing to chance. Wherever possible, such facilities are automatically operated. Typical example is the single control that operates both the lights and exhaust fan in the paint spray booth in the small motor department.

Here, a single normally-closed pushbutton is equipped with a lever arm to operate like a limit switch. When hooked to the end of the lever, the weight of the paint spray gun lowers the arm and depresses the pushbutton which, in turn, opens the contactor controlling the fan and light circuit.

When the mechanic takes the gun off the hook, the lever rises and the pushbutton closes the circuit turning on the lights and exhaust fan. There is no possibility of the mechanic forgetting to turn either on or off, the pushbutton does the job.

You can always rely on Raco



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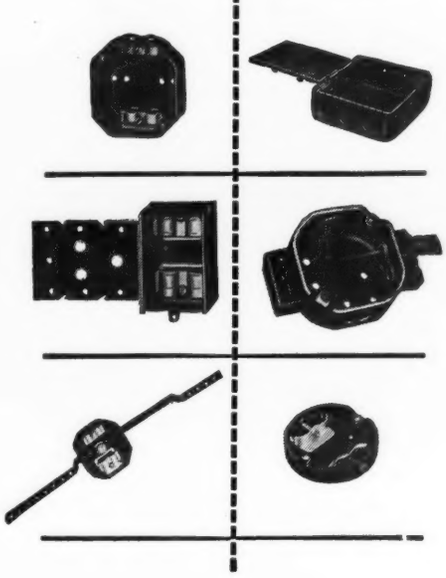

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Profit by the line of least sales resistance! It's no secret that designers, architects and electrical contractors—the country over—prefer and demand the RACO line. There's a box and cover, accurately made and machined, tailored to fit the particular needs of every type of installation. Sturdy RACO boxes in their smooth, lasting black or galvanized finish, are built to do the job right!

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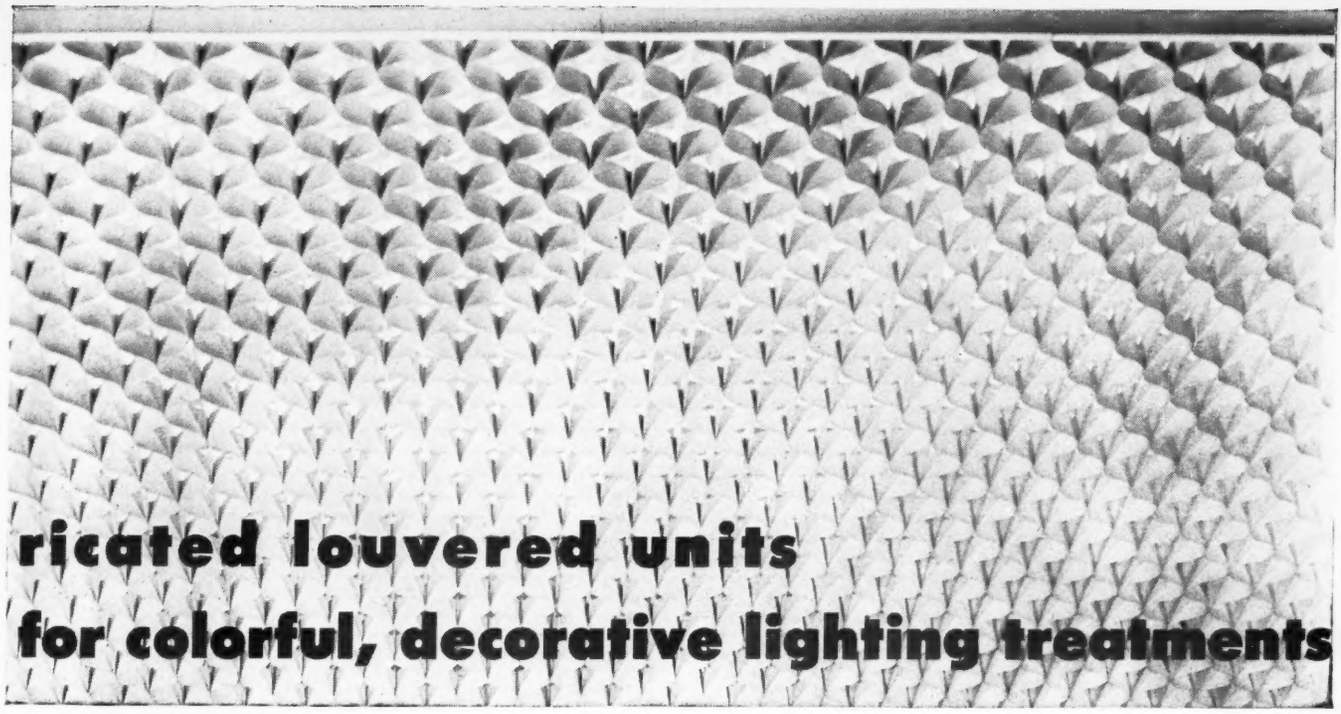

ricated louvered units for colorful, decorative lighting treatments

Cell-Ceil is the louvered ceiling that will assure lasting beauty. Made in harmonious decorator colors of Acme Galva-Bond* steel, these Cell-Ceil sections cannot warp. Acme Galva-Bond* steel is a protection against loss of color or corrosion.

With any type of lighting Cell-Ceil will reduce all direct glare and give a soft, diffused light. Also eliminates the bad effect of sharp shadows. Cell-Ceil provides a uniform lighting unit.

Cell-Ceil standard light-weight sections, suspended from overhead, simplify installation problems in new construction or remodeling. All sections match perfectly giving a continuous one-piece look, hiding ceiling pipes, sprinkler heads, ventilation ducts, etc., yet provide easy access for relamping and cleaning.

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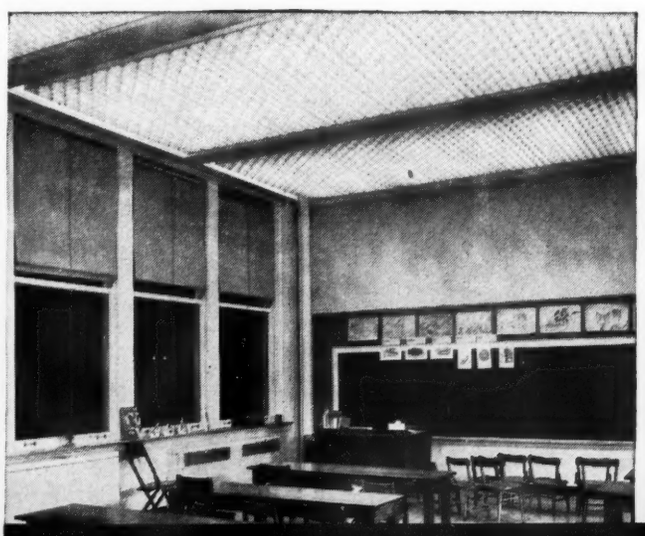

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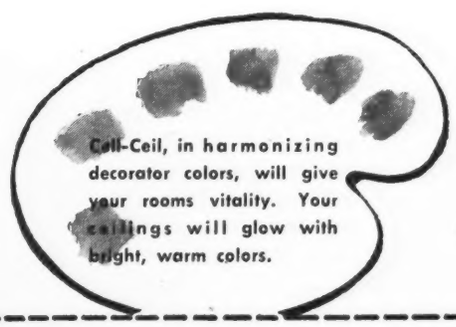
Cell-Ceil, in harmonizing decorator colors, will give your rooms vitality. Your ceilings will glow with bright, warm colors.

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"We never know when it's raining"...

A battery of 3-lamp Day-Line fixtures individually hung from Hydee Hangers provides excellent visibility for typesetting in the composing room of Warwick Typographers, 920 Washington Ave., St. Louis, Mo.

says this delighted user of DAY-BRITE Lighting Fixtures

We're quoting verbatim from this firm's own house organ:

"There are no gloomy, dreary days for us folks here at Warwick. Our new home is equipped with an ultra-modern type of "Day-Brite" lighting.

"We've noticed that this plenty-bright but scientifically diffused, shadowless lighting has helped our morale. There are no personal-efficiency "peaks" and "valleys" due to the weather... but a steady, smooth output, day after day."

Day-Brite Heavy-duty industrial fluorescents are optically-engineered for glarefree, restful vision... lasting efficiency... easy, low-cost maintenance.

The **DAY-LINE** heavy-duty industrial fluorescent fixtures are designed for two and three 40-watt and two 85-watt lamps. Sturdy, porcelain enameled reflectors... truss-type channel construction... unit or continuous installations. The 40-watt fixtures are equipped with the new TURRET sockets and open or closed end reflectors.

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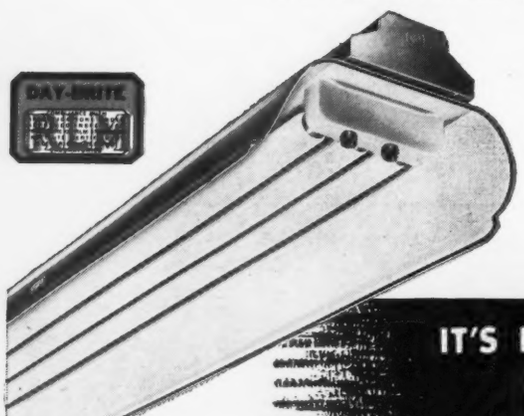


May we send you bulletin 3-A-2 with complete details?

Day-Brite Lighting, Inc., 5402 Bulwer Avenue, St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.

In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

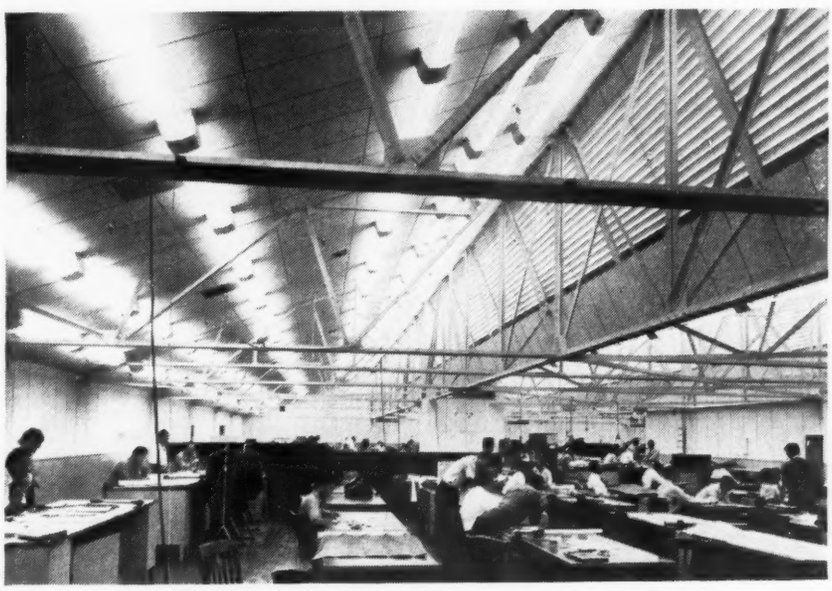
009

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

Modern Lighting

View of second floor area at Douglas' El Segundo plant before modernization and relighting was started.



The same area after relighting. Note how spacing of units on ceiling incline varies to produce uniform light levels regardless of fixture height.

Cold Cathode Lights Engineering Areas

When the engineering and drafting rooms of the Douglas Aircraft Company's El Segundo, California, plant were remodeled and relighted, cold cathode fixtures were installed throughout the 81,000 sq. ft. area. Wherever possible, the four-lamp, General Luminescent "Simplicity" fixtures (83-in., 25 mm., C-75 Colovolt tubes) were surface-mounted in continuous rows. Lamps are 3500° white.

Among the features that influenced the decision to use cold cathode units were:

1. The fixtures were designed for continuous installation with conduit assemblies. On this installation, only one outlet was required for an average of nine fixtures.
2. The ballasts furnished operate satisfactorily on either 50 or 60 cycle supply. A contemplated change to 60 cycle operation would require a 50/60 cycle ballast, or 60 cycle ballasts with compensators for hot cathode fluorescent units.
3. The 10,000 hour lamp life.
4. The absence of starters.
5. Because of the low surface brightness of the tubes, enclosing globes or diffusers would not be necessary and hence fixture maintenance would be reduced.
6. The anticipated frequency change from 50 to 60 cycles would increase the light output approximately 30 percent and would compensate to a large extent the loss of lamp efficiency and reduced reflection factor of the ceiling and wall areas.

In the ground floor drafting room, the units were mounted at right angles to the tables, on 8-foot centers. The 10-foot ceiling was covered with Celotex (rough side exposed) and sprayed with two coats of White Casine Lithophone Paint. Reflection factor is approximately 65 percent. After some two months *operation on a 50 cycle supply*, the light intensity on the drafting tables ranged from 45 to 52 footcandles. Units are used approximately 18 hours per day, five days per week. Approximately 30 percent more wattage consumed and proportional light output increase is expected when the supply system will be changed over to 60 cycles in the near future.

The second floor roof is of sawtooth construction. Modernization consisted of eliminating former suspended fixtures, concealing air ducts, installing Celotex on ceiling and walls and, in general, dressing up the area. Continuous rows of cold cathode, unshielded, fixtures were installed on the ceiling incline parallel to the length of the room. Fixture spacing was varied to miss structural members; avoid sprinkler heads and risers; and to provide uniform lighting on the drafting tables regardless of the mounting height of the fixture.

Comprehensive tests made by Douglass engineers revealed the following interesting data: The capacity lamp operates at 118 milliamperes (mfgrs. data); the inductive lamp at 122 milliamperes. Overall wattage for a single fixture leveled at 152 on 50 cycles

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"On-off" time switch. Controls stokers, oil burners, pumps, commercial lights, signs, etc. 3000 watt cap.

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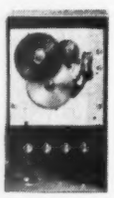
7-day calendar dial for control of automatic heating, ventilating and air conditioning systems.

G SERIES

Heavy duty "on and off" control for commercial and industrial applications. Also 2-circuit types.

J SERIES

Automatic cycle repeater control for stoker hold-fire, batch mixing, pump operation, liquid agitation, etc.



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BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

First floor drafting room has continuous rows of fixtures at right angles to tables. Single row of units along wall at left helps maintain uniform illumination.

after 15 minutes operation; on 60 cycles, 217 watts after a similar period. Fixtures consumed approximately 10 percent more wattage during warmup.

Comparison of lighting for the two floors on 50 cycle operation revealed 3.63 watts per sq. ft. for the second floor; 2.62 watts per sq. ft. for the ground floor. Based on previous tests, operation on 60 cycle is expected to produce 4.70 watts per sq. ft. for the second floor and 3.40 for the first floor.

Maintenance for the 1,400 fixtures (5600 lamps) has averaged eight man-hours per day of operation despite the "bugs" normally expected in a new unit or installation.

Employee reaction to the new lighting generally has been quite favorable. They have commented that the lighting is the best they have worked under, has less shadows and reflected glare, less brightness contrast, reduced surface brightness and there is no hum.

Light and Plastics Form Murals

Acrylic plastic sheets which "pipe" light from one edge to the other, are being made into luminous murals. Decorative designs etched into the front surface of the plastic are caused to glow against an opaque background, from light entering through the edge of the plastic panel. Typical examples are shown in Figs. 1 and 2.

Designed and executed by the Endicott Corporation, Boston, Mass., the plastic murals are called "Plexiglas". The intricate designs are engraved in Plexiglas with ordinary woodworking tools. These plastic panels are installed in a shadow-box frame, with fluorescent lamps mounted at the edge of the Plexiglas. The light is then transmitted evenly to all parts of the panel and design. When the edge of the Plexiglas panel is colored with a translucent paint, the design glows in that same color. By using different colors on the four edges of the panel, unusual colorful effects are possible.

FIG. 1—Plexiglas murals in Sheraton Lounge, Hotel Sheraton, New York City, depict scenes of old New York in glowing colored light on acrylic plastic panels. Fluorescent lamps installed at edge of panels provides light on the etched designs.

Vaportight CONDULETS*

for electrical installations that are exposed to **weather, moisture, steam or non-combustible dusts**

JUNCTION CONDULETS - SWITCHES - RECEPTACLES - LIGHTING FIXTURES - CIRCUIT BREAKERS - PANELBOARDS

The illustrations show a representative selection from the hundreds of CONDULETS that are vaportight or when furnished with covers and gaskets become vaportight.

*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

Type X Obround Condulet with Blank Cover and Gasket

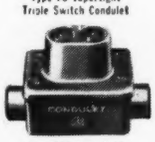
Type FSC Condulet with Blank Cover and Gasket

Type GSC Condulet with Blank Cover and Gasket

Type CRT Vaportight Condulet

Type C Obround Vaportight Switch Condulet

Type FS Vaportight Triple Switch Condulet

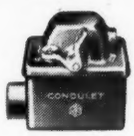

Type FSC Vaportight Push Button Station Condulet

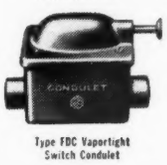
Type FSC Vaportight Plug Receptacle Condulet

Type VPH Vaportight Indirect Lighting Condulet 150 – 200-Watt

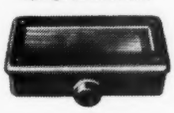
Type AHG Vaportight Flexible Fixture Hanger

Type FS Vaportight Switch Condulet


Type FD Vaportight Switch Condulet

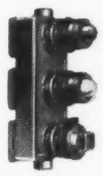

Type FDC Vaportight Switch Condulet

Type FS Two-Gang Vaportight Switch Condulet


Type FS Vaportight Lighting Fixture

Type FSC Two-Gang Tandem Condulet with Vaportight Switch and Plug Receptacle

Type VDB Vaportight Lighting Condulet 300 – 500-Watt


Type FCP Three-Gang Vaportight Panel Mounting Condulet with Pilot Lights and Switch

Type VCR Vaportight Lighting Fixture for CRF Series Condulets

Type GS Vaportight Lighting Fixture for GS Series Condulets

Type VC Vaportight Lighting Condulet

Type GS Vaportight Lighting Fixture for GS Series Condulets

Type VDA Vaportight Lighting Condulet with Dome Reflector 100 – 200-Watt

Type FSC Two-Gang Vaportight Combination Push Button Station and Pilot Light Condulet

Type V Vaportight Lighting Condulet for Mounting on Machines

Type V Vaportight Heavy Duty Lighting Condulet with Shatterproof Glass

Type VDA Vaportight Tank or Vat Light Condulet

Type ARC Vaportight Lighting Fixture for Obround Condulets.

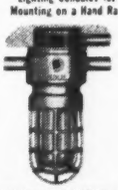
Type VC Vaportight Lighting Condulet

Type V Vaportight Lighting Condulet with Dome Reflector 100 – 200-Watt

Type VDA Vaportight Lighting Condulet

Type VXHA Vaportight Lighting Condulet with Flush Hubs

Type VR Vaportight Lighting Condulet for Mounting on a Hand Rail


Type VXJ Vaportight Lighting Condulet for Extensions from Concealed Conduit

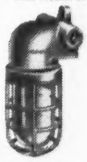
Type VS Vaportight Hand Lamp with Rubber Handle

Type VDA Vaportight Lighting Condulet with Angle Reflector 100 – 200-Watt

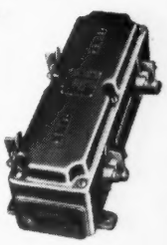
Type RCD-8 Vaportight Lighting Fixture for Wall Mounting

Type VFC Vaportight Gauge Lighting Conduleт

Type WV Vaportight Lighting Condulet with Fresnel Lens

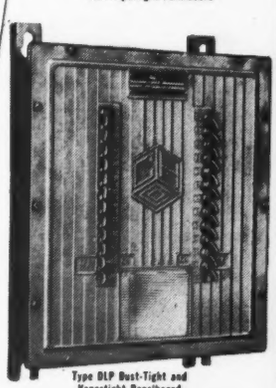

Type VJ Vaportight Lighting Condulet

Type VLG Vaportight Gauge Lighting Condulet Fluorescent


Type YSW Vaportight Circuit Breaker Conduleт

Type DVSP Dust-Tight and Vaportight Panelboard

Type DVSP Dust-Tight and Vaportight Panelboard


Type DLP Dust-Tight and Vaportight Panelboard

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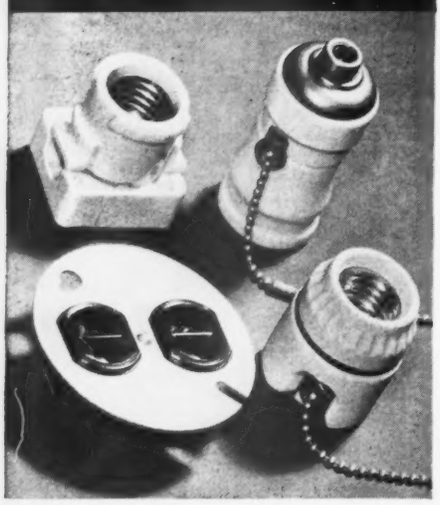

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FIG. 2—Large four-foot by twelve-foot Plexiglas panel in Waldorf Restaurant, Newark, N. J., displays decorative designs in bright orange color against reddish-brown background.

Three Plexiglas edge-lighted murals in the new Sheraton Lounge, Hotel Sheraton, New York City, are shown in Fig. 1. Each panel represents a scene of old New York, and glows in multi-colors to provide decoration as well as supplemental room illumination.

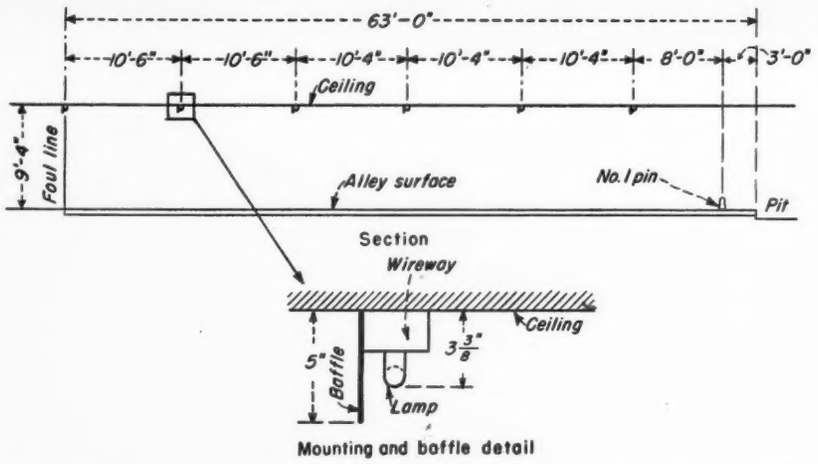
Fig. 2 shows a Plexiglas mural measuring twelve by four feet. It is installed in the new Waldorf Restaurant, Newark, N. J., and indicates the decorative possibilities of this medium. The mural is composed of three individual panels, which are mounted in a single frame and lighted by fluorescent lamps from the top and sides. A light orange color is applied to the edge of each panel so that light entering the panel carries this color to each portion of the designs. The designs glow with a warm orange color against the reddish-brown backing on the panels.

Fluorescents Light Alleys Uniformly

According to recent statistics, bowling is America's Number One sport. More people participate in this game as players than in any other game. Also, according to recent statistics, fewer people are going to movies now than was the case a few months ago.

This may or may not have anything to do with Dee's Bowling Hall, in Rochester, New York. This well-

Dee's Bowling Hall, Rochester, N. Y., formerly a movie house, is uniformly lighted to 25 footcandles with six single rows of 40-watt fluorescent lamps, seven lamps per row.



Mounting and baffle detail

Detail of fluorescent strip light with shielding baffle, and spacing of strips in bowling alley.

lighted, up-to-date bowling hall has been installed in what was previously an old neighborhood movie house, formerly the National Theatre. As can be seen in the accompanying picture the changeover, made by the Messrs. D. D'Amato, has resulted in an attractive and well designed bowling hall complete with six alleys.

Six rows of fluorescent strip lights, installed at right angles to the alleys, provide even, glareless, and comfortable lighting throughout. Each row contains seven 40-watt 3500-degree white fluorescent lamps, mounted on a metal wiring channel. High power factor ballasts were used to reduce stroboscopic effect and to provide more efficient operation.

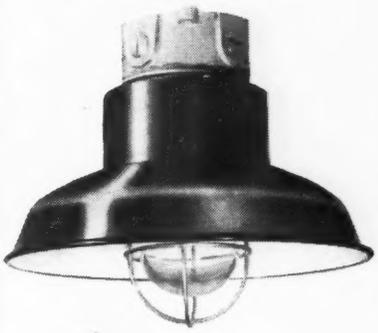
The rows of fluorescent strips are installed directly on the light ivory Celotex ceiling. A five inch wide tempered press wood baffle, finished to match the ceiling, is installed alongside each strip light on the bowlers' side, to shield the lamps from view of the players.

A lighting intensity of 25 footcandles maintained in service is obtained. The light ivory finished ceiling, light green side walls, and light maple finish on all woodwork contribute to high light utilization and also provides an attractive and comfortable atmosphere for bowling. Mat surfaces, except for alleys, and proper shielding eliminates annoying specular reflections.

The Lighting Division of the Rochester Gas & Electric Corporation planned this lighting installation.

A central banking institution in downtown Cleveland has recently installed 1800 Wakefield 2/40 watt fluorescent units throughout its work areas. The units are installed in continuous rows on Curtistrip, 11 ft. 3 in. from the floor. The ceiling is white acoustical tile, side walls are ivory with 50 percent reflectivity, and dado is deep beige with 28 percent reflectivity. The intensity averages 50 to 55 footcandles throughout. H. B. Durkee Electrical Co., Cleveland, electrical contractors, made the installation.

A WINNER



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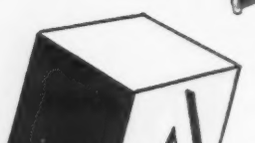
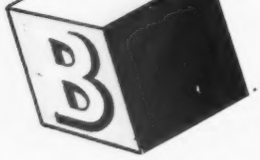
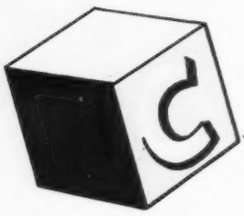


. . . APPROPRIATE

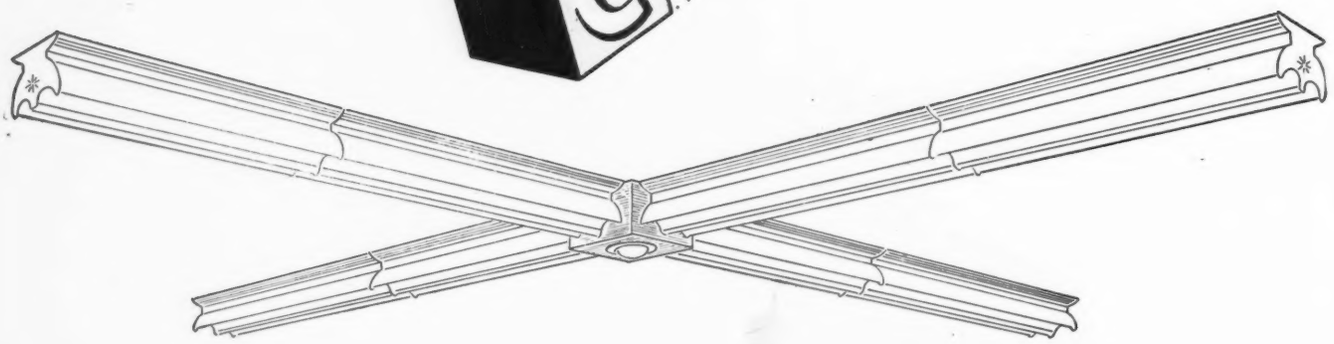
The Curtis Skylux . . . newly designed for A B C lighting is a low-brightness unit now made with Alzak aluminum reflectors and lamp shields. This new Skylux offers greater ease of installation . . . lower maintenance costs . . . more compact dimensions . . . lighter weight. Skylux luminaries utilize two, T-12, 40-Watt fluorescent lamps and are available for pendant or ceiling mounting, as individual units or continuous lines. Curtis Downlights, for use with the newly designed Skylux provide an efficient and economical method of delivering "punch" lighting for merchandise displays.



. . . BRIGHTNESS



. . . CONTROL



Appropriate Brightness Control, the big feature in modern lighting. The KEY? . . . the luminaire . . . the CHARACTERISTICS? . . . high light utilization with low unit brightness. PLUS the relationship of the chromatic values of room contents. Write Curtis for further details.

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F. N. M. SQUIRES and GLEN ROWELL
Chief Inspector, New York Board of Fire Underwriters, New York, N. Y.
Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

Questions on the Code

Non-Metallic Sheathed Cable and Concrete Blocks

Q. *This question concerns the use of Romex. On a cement block building (outside walls), the buildings are furred out for a plaster lath with ¾-inch stripping run vertically with no cross pieces; the outside has about ¾-inch coating of stucco applied directly to the block; this is supposed to be watertight. There doesn't seem to be any question of mechanical damage to the Romex. Now our Local Inspector has passed this without any E.M.T. or conduit over the Romex. I think he is right, but some of the contractors and lighting company people have condemned him for it. The practice in the past has been to slide a piece of E.M.T. or conduit over the Romex. It would seem to me that this would only act as a funnel to let the condensation that might be in the E.M.T. or conduit, to run down into the outlet box. The Inspector nor anyone else has no recourse to anyone higher up as there is no such thing down here. I might add that this city itself allows the Romex without covering of any sort where the wall is furred out two inches or more. I don't think that there is much difference, if there is a wet condition the Romex would dry quicker if not inside conduit or E.M.T.*

Another thing that might be of interest to you and which I think is the worst kind of a condition, is the general practice down here of using concentric cable to run from outside meter pans to switches and circuit breakers inside the house, the distances being anywhere from 6 to 30 feet, without any fuse or breaker protection for those concentric cables. This means that whatever amperage happens to be in the outside service wires would be inside the building without any protection to the user or any means of shutting the power off without breaking the meter seal and pulling the meter out of the socket. I think this is a vile condition.

Any information on this subject would be appreciated and I know that the inspector and many contractors feel the same as I do.—H.S.

A. Section 3362 of the Code states that non-metallic sheathed cable shall not be embedded in masonry, concrete, fill or plaster nor run in a shallow chase in masonry or concrete and plastered over.

It also states that the cable may be run in the air voids of concrete masonry blocks, where such walls are not exposed to excessive moisture or dampness and that has generally been taken to mean that its use in outside concrete block walls, is taboo.

The side of a concrete block farthest removed from the outside of a house and especially where the outside is covered with waterproof stucco, is not considered damp and therefore non-metallic sheathed cable (whether it is Romex or some other make) may be run within the furred space without any other covering.

In the matter of running service entrance cable into the service equipment box inside the house (whether there is an outdoor meter or not), does not present an undue fire hazard, provided the service equipment (service switch and fuse) is installed at the point nearest to the entrance of the wires into the building. This does not mean 30 feet from where they enter, although they may be about six feet in, in order to be readily accessible.—F.N.M.S.

Individual Conductors

Q. *On a concealed knob and tube job do all splices have to be accessible?*—M.M.

A. If the individual conductors are supported by knobs or tubes at intervals not in excess of 4½ feet apart with a knob within 6 inches of each tap, the N. E. Code does not require the splices or taps to be accessible. If the individual conductors are fished within the hollow spaces of a building, each conductor must be continuous from outlet to outlet and must be enclosed within flexible tubing extending from outlet to outlet or from point of support to outlet. Splices or taps on fished knob and tube installations must be accessible. See Sections 3244 and 3245.—G.R.

T Rated Switches

Q. *We have been told that a snap switch bearing a T rating is capable of handling current inrush in excess of its actual carrying capacity. With that in mind we recently installed several ½ hp. single phase 110 volt motors and used 10 ampere T rated snap switches for their control. Now we have been advised that we must use a 15 ampere switch. Is this a definite Code rule?*—J.W.

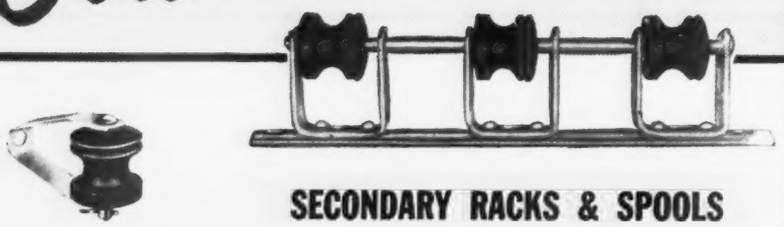
A. Yes, the N. E. Code under Section 4383-b states that for motors of 2 hp. or less the controller may be a general use switch, but it must have an ampere rating of at least twice the full load current rating of the motor it will control. Hence for the ½ hp. 110 volt single phase motor the control switch will have to be rated at 14 amperes or more.—G.R.

Meter

Q. *A commercial building is under construction having two panels; each panel is protected with a 100 amp. disconnect, only one meter will be used. Will these two switches be in accordance with the Code or should there be one main disconnect for the building?*—C.H.C.

A. If the two panels are grouped at the service entrance point and the disconnects are approved as service switches, these two switches could serve as service switches without a main disconnect ahead of them. As only one meter is to be used it would be connected on the line side of them.—F.N.M.S.

One Call Gets them all!



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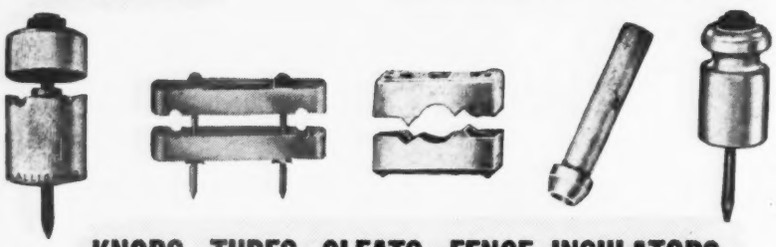

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OUTLET BOXES, SURFOLETS

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Switch Enclosures

Q. *We have the job of installing additional circuits in some wartime housing units. This can be done with a minimum amount of expense if we increase the service capacity by adding another 30 ampere switch to the one originally installed. The inspector here claims that we will also have to use a junction box ahead of both switches as he will not permit us to supply the new switch by tapping onto the line terminals in the existing switch. Is this a Code rule?* —H.C.T.

A. Yes, the N. E. Code under Section 3737-b states that switch enclosures shall not be used as junction boxes, troughs or raceways for conductors feeding through or tapping off to other switches unless the switch cabinet contains adequate wireways designed for such use. Therefore the inspector was referring to this section of the Code when he asked for the separate junction box.—G.R.

Official Interpretation

Q. *Will you kindly furnish this office with your official interpretation of the following questions with regards to compliance with the 1947 Electrical Code?*—C.H.C.

A. Please be advised that the answers given in these columns are *not* "Official Interpretations" of the Code. The answers represent only the views and opinions of the editors of this section of your magazine. Our opinions may be verified or they may be upset by an Official Interpretation. For the procedure to obtain an "Official Interpretation" see the appendix in the back of the National Electrical Code just preceding the Index.—F.N.M.S.

Grounding A Control Box

Q. *We are constructing a portable press which will operate on a three phase 440 volt circuit, the operation of this machine is controlled by a separate hand control box attached to the press by means of a hard service flexible cord. Will the Code require that this control box be grounded?*— W.B.

A. Yes, under Section 2545-c of the National Electrical Code you will note that exposed metal parts

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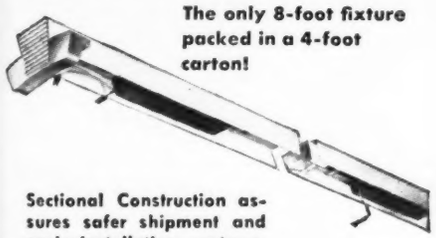

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...with beautiful "New Look" styling

The new MITCHELL Slimline Fluorescent Luminaire is easier to handle and install than any other 8-foot fixture available. Here's why: This unit features an exclusive construction in *two* four-foot sections, all ready to slide together to make a single sturdy 8-foot Slimline unit. It is shipped in a four-foot carton (much less liable to damage). Each section mounts separately on its own mounting plate to join perfectly as a single, smooth 8-foot unit. Installation is an easy one-man job—no hazards, no struggling with unwieldy ordinary 8-foot units.

Another MITCHELL exclusive is the hinge louver. This beautifully-contoured louver frame (Model No. 340) hooks quickly onto the basic open-type fixture—swings down on patented "trunk-lock" hinge mechanism for easy relamping and cleaning. Other practical MITCHELL Slimline advantages include instant-start, no-flicker operation, longer lamp life, reduced maintenance, and handsome "new look" styling.

The basic open-type unit is available in two models: No. 3020 with 200 milliamp ballasts; No. 3020-B with 300 milliamp ballasts. Channels are all-steel, finished in white baked enamel; beautiful end-pieces are die-cast, in Satin Aluminum finish. Units may be installed singly or in continuous rows, either flush or pendant mounted.

For supremely easy installation, wonderful versatility, and superb lighting efficiency, the new MITCHELL Slimline Luminaire is without equal in the field of modern commercial lighting application.

Send for Your MITCHELL POCKET CATALOG NO. 325!

Shows the Preferred *Complete* Lighting Line in one handy pocket book. It's the most effective Selling Guide ever prepared for the lighting trade! Write for it today.

MITCHELL

FIRST CHOICE IN LIGHTING

WRITE TODAY for MITCHELL Bulletin No. 322 which gives full illustrative and descriptive details on America's finest Slimline Luminaire.

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Far West: *Complete Modern Plant and Sales Office at Los Angeles Serves the Entire Pacific Coast Area*
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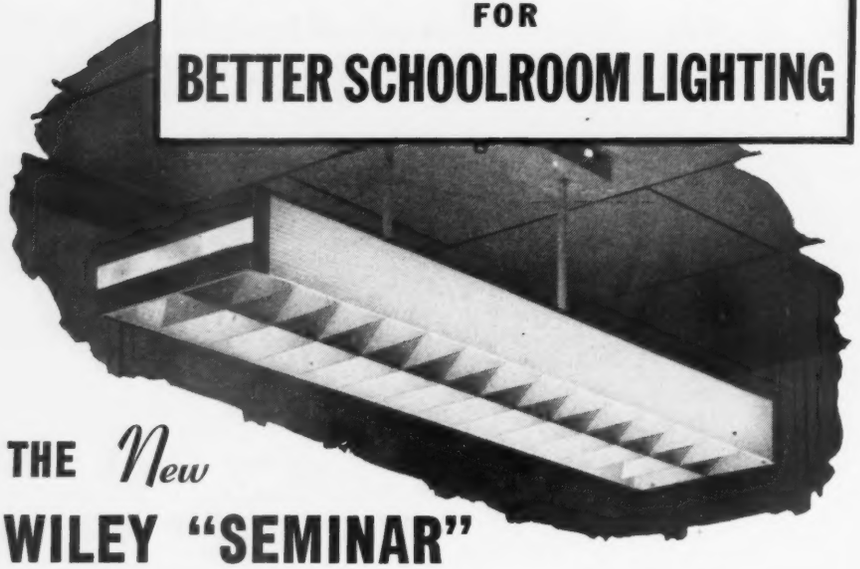
Especially Designed
FOR
BETTER SCHOOLROOM LIGHTING



THE *New*
WILEY "SEMINAR"
CERTIFIED FLEUR-O-LIER

● The new Wiley "Seminar" is designed especially to meet the particular requirements of planned schoolroom lighting.

The "Seminar" contains two 40-watt fluorescent lamps with starter or instant start certified HPF ballasts. It may be suspended or flush-to-ceiling, mounted singly or in continuous runs, to suit the architectural plan and light output requirements of individual classrooms.

The "Seminar" is a handsome fixture with POLY-LITE (Sandee) Side Panels that provides widespread down-light with uniform ceiling illumination. There are no curved or slanting sides to trap light or collect dust and dirt.

Attractively Priced—
Low Installation Cost
Economical Maintenance
I.B.E.W. Label

QUICK-ECONOMICAL SERVICE
The Wiley Seminar may be quickly dusted, cleaned and lamps replaced by one man without tools.

EXTREMELY HIGH EFFICIENCY
Copies of E.T.L. Performance Tests available on request.

R. & W. WILEY, INC.
Dearborn at Bridge St. Buffalo 7, New York

of portable appliances used in damp or wet locations or by persons standing on the ground or on metal floors or working inside metal tanks or boilers shall be grounded unless the supply of current is obtained through an insulating transformer having an ungrounded secondary of not more than 50 volts. Inasmuch as you will have no control over the location in which your product will be used, it would be advisable to comply with this section of the Code.—G.R.

Air Conditioning Units

Q. *When determining the size of service and feeders for an eight family apartment house in which each unit will have its own air conditioning unit, is it necessary that we use a 100 percent demand factor for the combined total load of the eight units?* —J.H.P.

A. It is assumed that the air conditioning units consist of electrically driven compressors and blowers. If that is true, it will be necessary to follow section 4314 of the N. E. Code. This requires that you use better than a 100 percent demand factor as you must take 125 percent of the full load current of the largest motor plus 100 percent of the other motors when determining proper size of both feeders and service switch. You will note Section 2203f of the Code refers one to Section 4314 mentioned above.—G.R.

Voltage Limitations on Elevators

Q. *Is there any part in the National Electrical Code which forbids the use of 410 volt circuit in an elevator hatchway? Does the NEC state that not more than 300 volts to ground can be permitted in any push-button controlled elevator?*—R.C.L.

A. The answer to your question is found in Section 6202 of the Code, which is as follows:

6202. Voltage Limitations. The following voltage limitations shall apply to elevator-control and operating equipment:

a. Car Control System. No part of any electric circuit having a voltage in excess of 750 shall be used on any car control system. Circuits of higher voltage may be used in machine rooms or pent houses for the operation of motors and brakes, provided that all control and signal wiring is thor-

oughly insulated from such power circuits, and all machine frames and metal, hand-operated ropes are permanently grounded.

b. Automatic Elevators. The maximum voltage permitted in the operating devices of automatic elevators, having operating devices in the car and at the landings, shall be 300 volts to ground.

c. Push Buttons. The maximum voltage permitted on the push buttons of elevator signalling circuits shall be 300 volts to ground.

You will note that nothing in the above prohibits running the 440 volt circuits through an elevator hatchway, providing the conductors are installed in rigid conduit or electric metallic tubing, but does limit the use of 440 volts on the control and signalling circuits.—F.N.M.S.

Switch For Motor

Q. *The disconnect switch for a 10 hp. 230 volt three phase motor according to Section 4402 must be rated in horsepower and under Section 4403 must have a current carrying capacity of at least 115 percent of the nameplate current rating of the motor. Obviously one of these sections is wrong as a switch bearing a 10 horsepower 230 volt rating would have much greater carrying capacity than a switch rated in amperes with 115 percent of 27 amperes or 31 amperes. Can you explain this apparent discrepancy in the Code?*—M.A.

A. The N. E. Code under Section 4402 states that the disconnecting means shall be rated in horsepower with four exceptions, so unless the motor is rated at two horsepower or less or it exceeds 50 horsepower or is a portable motor, the switch must be rated in horsepower. Section 4403 states that the disconnect switch must have a current carrying capacity of at least 115 percent of the name plate rating of the motor. This section may seem misleading. However, the intent is that it will be applied for motors of more than 50 horsepower or for the attachment plug and receptacle used for portable motors or the fuse used on stationary motors of $\frac{1}{8}$ horsepower or less. Therefore for motors of more than two horsepower but not exceeding 50 horsepower, the disconnect switch must be rated in horsepower. For motors larger than 50 horsepower the disconnect may be a general use switch rated at not less than 115 percent of the name plate rating of the motor. When such a switch is used, it should be plainly marked "Do Not Open Under Load."—G.R.

RCA TUBES FOR INDUSTRY

RCA 833-A Power Tube

. . . available from your local RCA Tube Distributor

■ RCA has an industrial tube type for virtually every renewal requirement . . . and RCA tubes are directly interchangeable with other standard types.

For your convenience, RCA industrial electron tubes are now available directly from RCA or from your local RCA Tube Distributor.

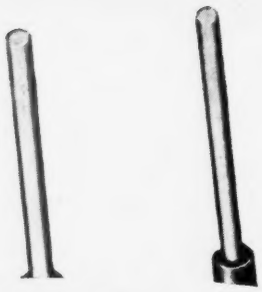
The Fountainhead of Modern Tube Development is RCA

Send for New Guide

RCA 16-page booklet contains the data you need for the quick selection of power tubes, voltage regulators, thyratrons, ignitrons or gas rectifiers for any installation or application. Ask for Bulletin PG-101. RCA, Commercial Engineering, Section HT77, Harrison, N. J.

TUBE DEPARTMENT
RADIO CORPORATION of AMERICA
HARRISON, N. J.

More current-carrying capacity for *less* money... with Rome Type RH Building wire



That's the simple reason why it is good economy to use Rome Type RH Building Wire. Type RH provides GREATER CURRENT CARRYING CAPACITY PER DOLLAR OF INSTALLATION COST.

As compared to all other types of Building Wires, National Electrical Code current carrying capacities and higher operating temperature for Type RH, permit, for equal amperages, the use of smaller conductor sizes in nearly every instance.

WHERE VOLTAGE DROP IS NOT A PROBLEM, as in most feeder circuits, you can realize all around savings . . . actual dollar savings . . . by installing "Rome" Type RH Building Wire.

HERE IS A TYPICAL EXAMPLE:

Circuit Requirement of 285 Amps.	Type R	Type RH
*Required Conductor Size	500,000 CM	300,000 CM
Approximate Outside Diameter	1.10"	.91"
Weight per 1000 Ft.	1815 Lbs.	1139 Lbs.
*Required Conduit Size (3 conductor)	3"	2½"
*Permissible Operating Temperature	60°C	75°C

** In accordance with 1947 National Electrical Code*

FIGURE FOR YOURSELF, the savings in cable cost, in this particular case as much as 26 percent . . . the savings of smaller conduit and fittings . . . the ease of handling lighter materials . . . the longer life of a superior heat-resistant insulation.

ADEQUATE WIRING SERVES AND SAVES

To Save Feeder Circuit Costs . . .
Specify Rome RH

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

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NEW LITERATURE

Latest catalogs and bulletins of manufacturers are available to you without cost through this Electrical Construction and Maintenance Reader Service

(1) REGULATING CONTROLS — Catalog D-130 describes resistors, rheostats and radio relays for laboratories, schools, industry and servicemen, including prices, dimensions and application recommendations. Ward Leonard Electric Co.

(2) LUMINOUS CEILINGS—Bulletin "sg" is complete 28-page presentation of specifications, installation data and technical information relating to Sky-Glo louver systems. Benjamin Electric Mfg. Co.

(3) INSULATING MATERIALS — Product list of electrical insulating materials, arranged alphabetically by manufacturer, is available. Insulation Manufacturers Corp.

(4) VINYLITE CABLE SHEATHING — Kabelitens 27 is resume of British regulations governing construction, testing and installation of plastics insulated and sheathed cable. Bakelite Corp.

(5) SHOP CRANE — File sheet presents data on hydro-lift 2000-pound capacity combination truck crane and shop lift for industrial, automotive and farm applications. Cardinal Corporation.

(6) RECESSED TROFFERS — Catalog T-48 is 36-page presentation of 1, 2 and 3-lamp 40-watt fluorescent deep and shallow type troffers. Photometric data, dimensions, weights and applications are listed. Ender Manufacturing Corp.

(7) WATTHOUR METER — Two color 16-page bulletin (4-48(10M)6110) presents watthour meter of new design, new operating principles and new materials. Photographs, sketches, charts, tables and text describe construction and operation. General Electric Co.

(8) INSTRUMENT AND TIMING MOTORS — Two catalog sheets discuss synchronous and non-synchronous motors, also gear motors with wide range of speeds. Construction, mounting and lubrication is discussed. Gleason-Avery, Inc.

(9) ELECTRIC DRIVE — Bulletin 311 presents all electric, adjustable speed drives for a-c circuits and includes data on torque, horsepower, graphs and other pertinent information. Reliance Electric and Engineering Co.

(10) SUBMERSIBLE PUMPS — Bulletin 48-5250 describes close-coupled pump and motor units for submerged operation. Various centrifugal and turbine types of sealed oil-filled units are described. Byron Jackson Co.

(11) MULTITESTERS — Hi-meg multitesters, series 450, are specified in bulletin sheet 133. Six units in portable and open face models with resistance ranges of 50 to 1000 megohms are included. Radio City Products Co., Inc.

(12) ELECTRIC FITTINGS — Catalog 448 includes complete data on outlet boxes, receptacles, mounting accessories, fittings and forming tools, with weights, dimensions and prices. Lew Electric Fittings Co.

(13) WIRING ACCESSORIES — File and price sheets present pertinent data on splice caps, terminal lugs, crimping tools, box connectors, cable clamps, conduit bushings, terminal blocks and attachment plugs. Buchanan Electrical Products Corp.

(14) PERMANENT MAGNETS — Booklet CDM-16 describes permanent magnet sub-assemblies, such as magnetic focusing, Titan valve, magnetron,

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330 West 42nd St.

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cable clamp, radar jammer tube and snap action switch. General Electric Co.

(15) LIGHTING LINE — Catalog 325 is 28-page presentation of complete lighting line, designed as selling guide for electrical contractor-dealers, architects and utilities. Units are both general and specially designed, industrial and residential, portable and fixed. Mitchell Manufacturing Co.

(16) AUTOMOTIVE SERVICE—Improvement suggestions for service stations, car dealers, garages and repair shops contain numerous lighting ideas for illuminating exteriors, interiors, shops and special display or work areas. Benjamin Electric Mfg. Co.

(17) TOOLS AND ACCESSORIES — Accessories designed for power drives, knife cutters, threading units and related equipment are listed and priced in folder. Beaver Pipe Tools.

(18) INSTRUMENTS — Panels, switchboards, switches, relays, balancing and measuring units, accessories and mounting aids are conveniently classified in file catalog complete with technical data and prices. Roller-Smith Div. Realty and Industrial Corp.

(19) DRY UNIT SUBSTATIONS — File series TU-56 presents information concerning dry-type unit substation transformers, with attention directed to switches, breakers, terminal entrances, windings, enclosures and accessories. Wagner Electric Corp.

(20) TESTING INSTRUMENT—Bulletin 441 discusses 4-in-1 B-6 Megohmer for insulation testing, ohmmeter use and both a-c and d-c voltmeter applications. Herman H. Sticht Co., Inc.

(21) INFRARED APPLICATIONS—Booklet A-3817, titled "Modern Baking, Drying, Heating with Industrial Infrared Lamps" includes description of radiant heat processing for wide variety of industrial applications. Westinghouse Electric Corp.

(22) RESIDENTIAL LIGHTING — Outdoor and indoor lanterns, bath brackets, bed lamps, fluorescent utility units and recessed louvered or glass-panel assemblies are presented in temporary catalog. Progress Manufacturing Co., Inc.

(23) SCAFFOLDS — Folder describes aluminum alloy scaffold that is lightweight, portable, stable and adjustable for height and uneven bearing surface. Method for erecting is detailed. Up-Right Scaffolds.

(24) TRUCK BODIES — Steel bodies for service and maintenance trucks, giving dimensions and compartment arrangements, are presented in 4-page folder with assortment of accessories which may be used in truck bodies. Artisan Products, Inc.

(25) LAMPS AND WIRING DEVICES — Catalog 48 includes technical data on attachment plugs, connectors, sockets, portable lamps, cord sets, test leads, guards, fuse boxes, transformers and related equipment. The Ericson Manufacturing Co.

(26) RELAYS — Complete line of small, compact, varied selection of relays are specified according to contact rating current, coil operation, ohms, volts and amperes in new Relay Guide. Allied Control Company, Inc.

(27) MALLEABLE FITTINGS — Pocket catalog contains all essential data on EMT fittings and entrance heads. Tabular information on other related items is included in folder 48-A. Wagner Malleable Products Co.

(28) STORAGE BATTERIES — Specification and testing of materials, voltage measurement, metallic compound analysis, structure of cast lead and methods used in research are contained in brochure titled, "Better Batteries for Industry through Research." Gould Storage Battery Corp.

(29) INSULATIONS — Handbook of compounds and waxes for electrical insulation includes physical characteristics, formulas, facts and figures pertaining to impregnating and dipping waxes, seals and fillers, cements and compounds. Mitchell-Rand Insulation Co., Inc.

(*Continued on page* 132)

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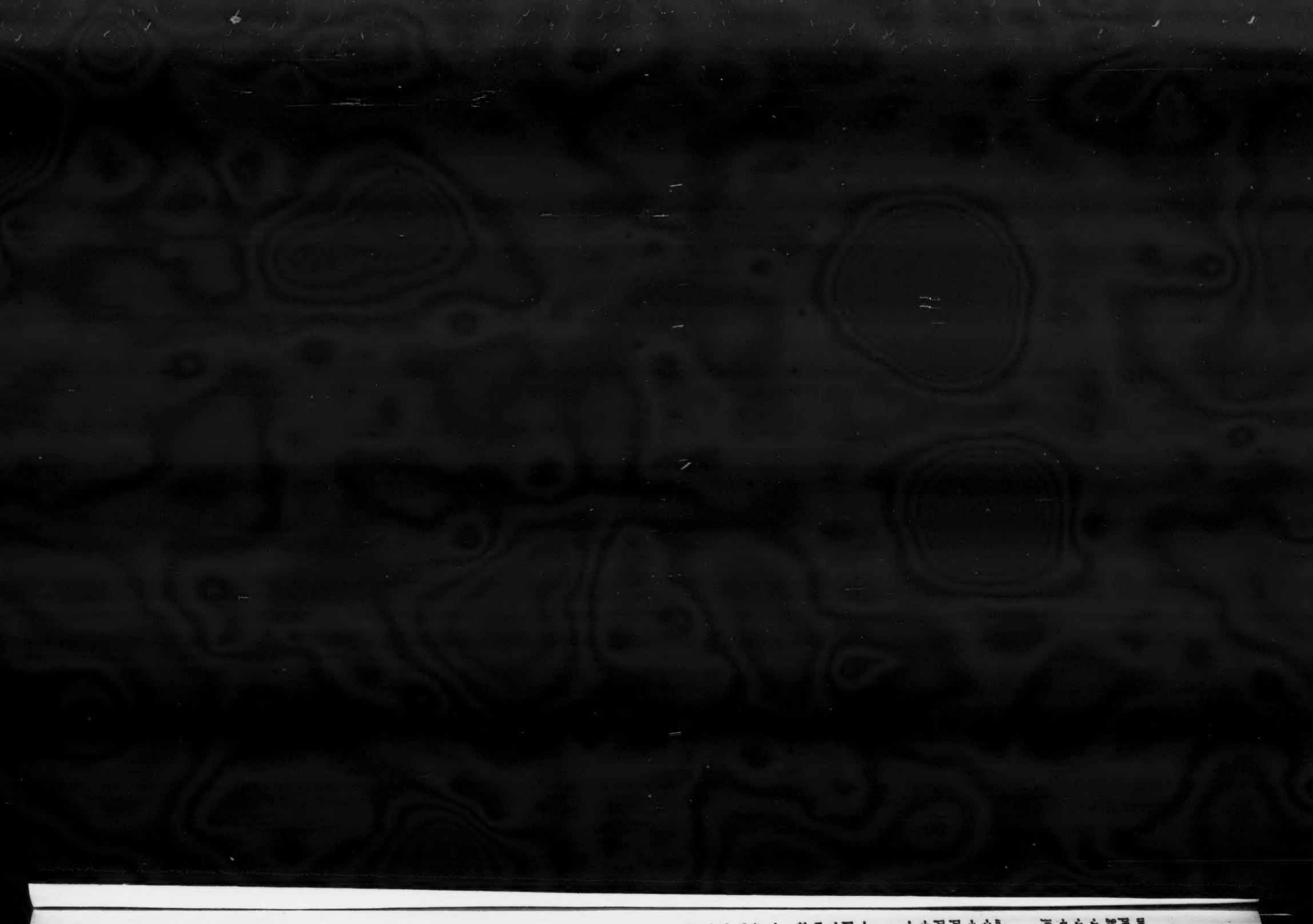

New H&H No. 9260

BACK-WIRED (or side wired) DUPLEX

T-SLOTS • DOUBLE SIDE CONTACTS
PLASTER EARS

This advanced design provides for either *back* wiring or *side* wiring with equal facility. Back-wiring feature makes easier, more secure installation. Built-in stripping guide assures correct stripping; eliminates exposed wire. Individual terminal clamps hold wires with a no-slip grip. Other structural features are:

CONVENIENCE OUTLET

- Large Recessed Binding Screws
- Ample for No. 10 Wire
- Strong Plastic Base
- Double T-Slots
- Double Side Contacts
- Washer Type Plaster Ears

Large recessed binding screws, ample for No. 10 wire;

Strong plastic base;

Double T-slots;

Double side contacts;

Washer type plaster ears.

Listed as standard by Underwriters Laboratories, Inc. and meets all high-grade specifications. Specify No. 9260 for brown plastic base; No. 9260-I for white Ivorylite.

10 AMPS. — 250 VOLTS **15 AMPS. — 125 VOLTS**

Mail this Coupon

To Arrow-Hart & Hegeman Electric Company, Hartford 6, Conn.

Send us your catalog data-sheet on the new 9260 Back-Wired Duplex Convenience Outlet.

(*Name*) _____

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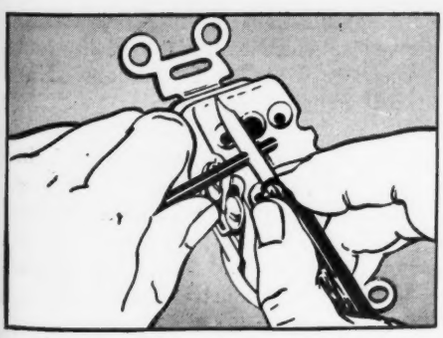
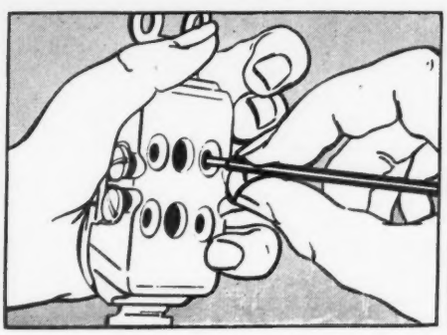
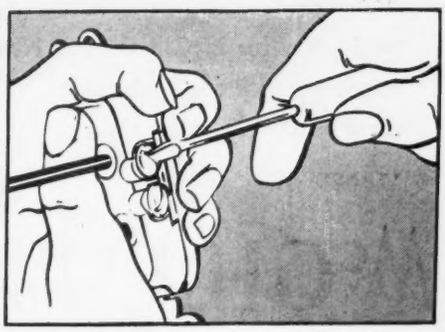
THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD 6, CONN., U.S.A.



1. Strip off insulation to exact length, quickly and easily, using built-in stripping guide.



2. Loosen terminal screw — Wire stripped to correct length is inserted from back.

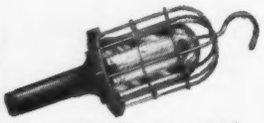


3. Tighten terminal screw — Individual clamps grip securely with no exposed wire.

McGILL* PORTABLE LAMP GUARDS

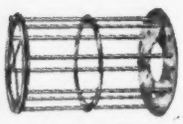
NOW BUILT WITH . . .
NEW No-Rol CAGE

No. 7000SR Portable Lamp Guard has the No-Rol cage made of zinc plated wire. Handle of moulded rubber features LEVOLIER Switch. Lamp Size — 40-100 W.



No. 3005 Vaporproof Guard has a heavy brass wire cage with sealed In-surok handle and air and moisture proof globe that is heat and impact resistant. Lamp Size — 100W.

No. 4675 uses solid polished Birch wood handle. LEVOLIER Switch. Cage of zinc plated heavy steel wire. Lamp Size–25-100W.



No. 1440 Wall Guard for protection of bulbs exposed to theft and damage.

McGill extra quality Soldering Paste and Sticks, Coloring Fluids and Insulating Compounds.

It's the latest development in portable lighting . . . designed to prevent rolling of the lamp guard after the light is trained on your work. Safety is also increased because the eared cage reduces "dead bulb" damage caused when portables roll from work tables and sever bulb filaments.

Numerous other advantages result from this new design improvement that provides for extended corners on the otherwise rounded cage exterior.

The No-Rol feature is your guide to better portable lighting . . . insured by the complete McGill line of lamp and wall guards designed especially to meet every requirement.

Send today for McGill Catalog No. 43 so you can pick out the lamp guard that most effectively solves your problems.

* TRADE MARK

McGILL MANUFACTURING CO., INC.
Electrical Division
450 N. CAMPBELL ST., VALPARAISO, INDIANA

NEW LITERATURE

[FROM PAGE 130]

(30) LINEMAN EQUIPMENT — Descriptive folder and price list presents data on climbers, belts, supporters, holsters, pouches, tools and accessories required by linemen. Buckingham Manufacturing Co., Inc.

(31) DRILL BITS — Catalog CB-48 lists price, dimensions, length and drill diameters of fluted carbide-tipped rotary and hammer bits, together with suggestions for sharpening and proper use. New England Carbide Tool Co., Inc.

(32) TIME SWITCHES — Heavy duty time switches, synchronous and synchronous carryover, discussed, including construction, speed, finish, applications and settings, are presented in 4-page 2-color folder. Sangamo Electric Co.

(33) THERMOCOUPLE WIRES AND CHARACTERISTICS — Two bulletins, GEA 4881 and GET 1415, list types of thermocouple wires and insulation materials, also output characteristics of common thermocouple wire materials. Tables comply with U. S. Bureau of Standards recommendations. General Electric Co.

(34) LIGHTNING PROTECTION — Catalog 48-A discusses the importance of lightning protection in radio, alarms and signals, telephone and telegraph circuits, presenting various types of equipment, together with sketches, wiring diagrams and technical data. L. S. Brach Manufacturing Corp.

(35) PLASTER FRAMES — Form OD-227 includes dimensions, mounting details and prices of plaster frames used in conjunction with recessed deep or shallow troffer fluorescent lighting fixtures. Day-Brite Lighting, Inc.

(36) CONDUIT GUIDE — Catalog and handbook includes details of three grades of rigid conduit, typical standard specifications, definition of terms, symbols, electrical data tables and typical problems with solutions. National Supply Company.

(37) TIME DELAY RELAYS — Bulletin 362 presents special features, wiring diagrams, dimensions and auxiliary equipment used in conjunction with motor drive type of time delay relays. Ward Leonard Electric Co.

(38) DRY TRANSFORMERS — Booklet B-4009 includes complete line of dry-

NOW-*for the first time ever*-you can sell all the G-E fluorescent lamps you want

HOORAY! Now you can make all your customers happy—help them fill those empty sockets, replace blackened or burned out lamps and go ahead with lighting modernization. Because, for the first time since General Electric introduced the fluorescent lamp 10 years ago, G-E fluorescent lamps are available in quantity!

WE'VE BEEN WORKING at top speed to build new factories, expand production to catch up with the ever-growing demand for the world's newest kind of light. With these new facilities now in operation, you can stock up on all the popular types and sizes you want. Only slimlines and circlines are still limited in quantity.

IT'S TIME TO CASH IN on the tremendous opportunities of fluorescent lamp sales—to push both replacement and new business as you've never been able to do before. And while you're doing so, don't forget your own place of business. Brighten up with new G-E fluorescent lamps—they'll help to bring in more customers!

WHY NOT SEE your G-E lamp supplier today? Now he can really greet you with a great big smile and an armful of those G-E lamps—the lamps that most people want *most!*

G-E LAMPS SELL ON SIGHT . . .

G-E LAMPS

GENERAL ELECTRIC

type transformers for motors, lights and other equipment operating on 120-240 volts. Cutaway photos and sketches augment the text. Westinghouse Electric Corp.

(39) Lighting Catalog — Residential and commercial incandescent and fluorescent units are included in catalog 48, including construction and installation details, light distribution curves and photographs of installations. The Kirlin Co.

(40) Fluorescent Guide — Bulletin "fl" includes information on industrial fluorescent units, including application, installation and illuminating data. Benjamin Electric Mfg. Co.

(41) Portable and Pin-Up Lamps — Folder includes sketches and physical data on variety of swivel, all-purpose, floor and table lamps. Kurt Versen Co.

(42) Soldering Guns — Descriptive sheet and price list presents all pertinent data on electric soldering guns. Weller Manufacturing Co.

(43) Indirect Residential Lighting — "Sight Savers" includes lighting fixtures designed to accommodate silvered bowl lamps for residences and apartment use. Silvray Lighting, Inc.

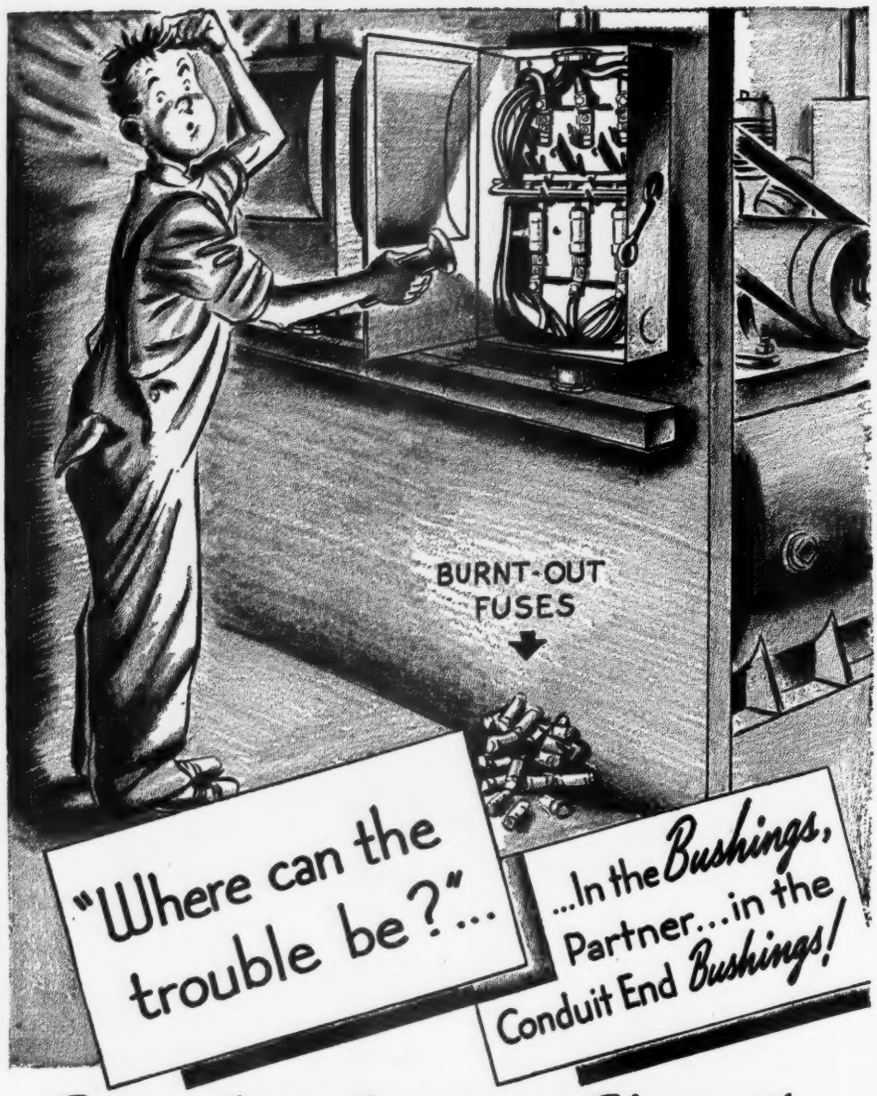
(44) Connectors — Three-color 32-page catalog C-47 covers 13 major type series of multicontact electric connectors for radio, aircraft, communications and related fields. Prices are included. Cannon Electric Development Co.

(45) Light Strip — Data sheet 553 lists prices and all physical information on single row light strips with asymmetric and symmetric reflectors. Day-Brite Lighting, Inc.

(46) Insulation Tubing — Non-fraying varnished tubing and saturated sleevings of finely braided cotton or inorganic glass fibre are illustrated in mailing folder. Insulation Manufacturers Corp.

(47) Rodding Equipment — Illustrated folder shows rodding operations from single manhole stations, methods for pulling and retrieving cables, application of power drive in mud boring, making turns and offsets, use of various tools and equipment. Flexible Sewer-Rod Equipment Co.

(48) A-C Motors — File folder lists ½, ¾ and 1-hp. motors with wide range of applications, weights, physical dimensions and electrical characteristics. Eicor, Inc.



Prevent Costly Grounds and Shorts with . . .

"UNION" INSULATED CONDUIT END BUSHINGS

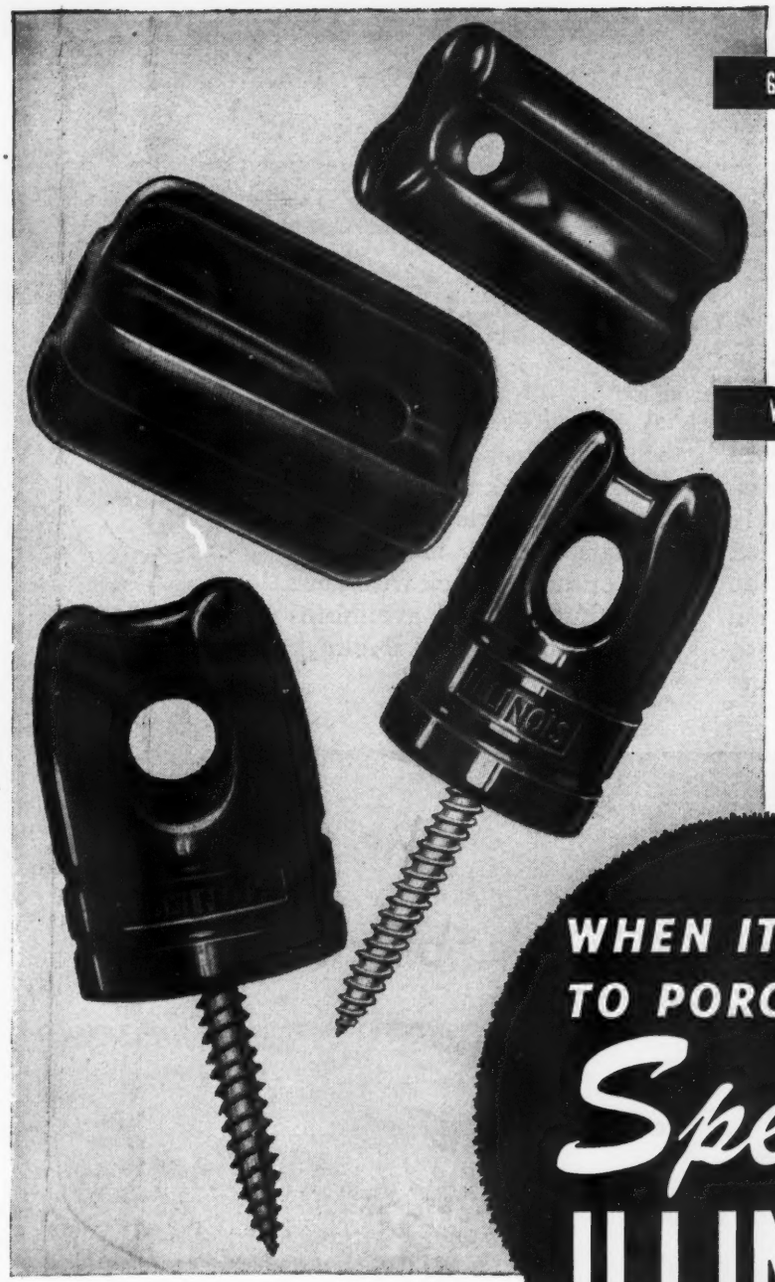
Molded of impact resistant Bakelite, "UNION" Insulated Conduit-End Bushings are particularly desirable in industrial locations.

They economically prevent costly grounds and short circuits. Inside lip of Bushing is beveled to prevent damage to wire insulations from vibrations during service or when wires are "pulled."

"UNION" Conduit-End Bushings, sizes 1/2" through 1" are molded from paper impregnated Bakelite, as used in "UNION" No. 43310 EXTRATUF Weatherproof socket. Sizes 1-1/4" through 6", from canvas impregnated material as in "UNION" No. 63310 Canvas Weatherproof socket.

Priced to make Insulated Bushings Preferred!

UNION INSULATING CO., INC.
PARKERSBURG, W. VA.



GUY STRAIN INSULATORS

ILLINOIS wet process insulators are made from highest grade materials under complete plant control. Internal stresses eliminated through careful, constant-temperature firing. Available in large stocks of standard sizes.

WIREHOLDER INSULATORS

The insulators you want for permanent installations. Hot galvanized all-steel screws have deep, sharp threads, permanently bound to insulators with non-shrinking metal alloy. Smooth, rounded surfaces protect wire insulation. Sufficient sizes and styles to meet all requirements.

WHEN IT COMES TO PORCELAIN.. *Specify* ILLINOIS

WHETHER for wireholders, insulators, or complete wiring systems, Illinois porcelain is your best bet. Years of experience combined with rigid production control bring you the very best in electrical porcelain when you buy ILLINOIS.

Sold only through Recognized Electrical Wholesalers

STANDARD TUBES

Glazed, unglazed, split, floor, split floor, headless, curved, crossover split, and crossover. Uniform inside and outside diameters. Sizes 1/2 to 48" long, 5/16 to 3" diameter.

KNOBS

Knobs that don't chip when installed. Cement coated, extra length nail—genuine leather washer—code standard. Wide variety of sizes.

CLEATS

Standard cleats of all sizes and types.

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

You never go wrong on rigid steel conduit
THE heavy steel walls of rigid conduit afford sure protection to wiring. Encased in steel, cables are safely shielded during construction and for the entire life of the building. When installation of floors is long-delayed, rigid conduit protects the system, free from harm by wheelbarrows and trucks of careless workmen, safe from thoughtless acts of intruders, undamaged by moisture or fire or dust. Check with your distributor for the availability of Youngstown Buckeye or Youngstown EMT.
QUALITY
YOUNGSTOWN
SERVICE
Youngstown
BUCKEYE CONDUIT

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

CONDUIT - PIPE AND TUBULAR PRODUCTS - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - TIE PLATES AND SPIKES.

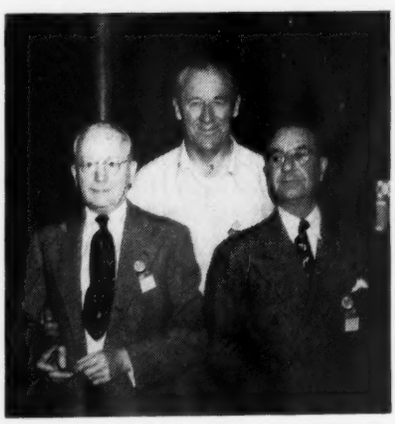
In the News

New York State Contractors Meet

"More Power To You" was the theme of the 49th annual convention of the New York State Association of Electrical Contractors & Dealers, Inc., which was held at Saranac Inn, N. Y., June 27-July 2. Over 300 members and guests were registered.

A. Lincoln Bush, chairman of the board, presided at the opening meeting of the convention. The program consisted of addresses by contractors, manufacturers, wholesalers and utility men. R. W. McChesney, president, National Electrical Contractors Association, discussed the "Electrical Contractor's Best Investment" and this was followed with a talk by E. C. Carlson, chairman, Labor Relations Committee, NECA, entitled "To Make More Money, You Must Increase Your Income".

L. W. Davis, executive secretary-treasurer, National Employees Benefit Board for the Electrical Contracting Industry, gave a report on the progress of the National Employees Benefit Program. "Why Electrical Contractors Support NECA" was presented by Paul M. Geary, executive vice president, NECA. D. J. Crimmins, executive secretary-treasurer, Joint Boards of the Electrical Industry, New York, talked about the value of organization.



An active part in the sessions of the 49th annual convention of the New York State Association of Electrical Contractors & Dealers at Saranac Inn, was taken by A. Lincoln Bush, chairman of the association and president of Belmont Electric Co.; S. J. O'Brien, president of S. J. O'Brien Sales Corp.; and H. C. Calahan, commercial vice-president, General Electric Supply Corp., all of New York City.

Harry C. Calahan, commercial vice president, General Electric Supply Corporation, New York, was chairman of the manufacturers and wholesalers day. Addresses were made by J. S. Parry, eastern industrial manager, Westinghouse Electric Corp., New York; Harry M. Parsons, vice president, Landers, Frary & Clark, New Britain, Conn.; Alexander Fisher, president, Commercial Radio-Sound Corp., New York; Barton B. Fagan, sales engineer, Sound Equipment Section, Engineering Products Dept., RCA Victor Division, Camden, N. J.; and R. C. Cassidy, manager of Uskon Sales, U. S. Rubber Co., N. Y.

Alston Rodgers, Lamp Department, General Electric Company, Nela Park, Cleveland, presented "New Horizons in Lamp Research" at an evening meeting.

The chairman for the utilities day was E. A. Brand, district commercial manager, Buffalo Niagara Electric Corp., Buffalo, and papers were presented by C. D. Hollister, lighting supervisor, N. Y. Power & Light Corp., Albany; R. Dewitt Pike, Supervisor, Commercial Division, Rochester Gas & Electric Co.; and R. Frank Brower, System engineer, Consolidated Edison Co., New York.

NEMA Urges Recognition For Electrical Inspector

The electrical inspector was singled out as one of the most important, but most unsung, of public guardians in a statement released recently as part of a national movement to win for him "at long last the recognition and compensation he so richly deserves."

The movement also is being pressed to insure retention of the highest standards of inspection service and the most competent personnel in the expanding and vital field of electrical safety.

The statement was issued by the National Electrical Manufacturers Association to municipal authorities and organizations. It warned that many inspection bureaus are working with skeleton staffs on a salary level that "portends a lower caliber of inspectors and a threat to public safety."

After detailing the varied qualifications and services required of inspectors, it appealed for immediate action on a program calling for:

1. Elevation of electrical inspection to its "proper position" in the municipal organization.
2. Provision for qualified additions to existing staffs.
3. Assurance of job stability.
4. Compensation in line with the responsibilities and importance of electrical inspection.

The statement emphasized the wide range of technical knowledge an inspector must have to handle his job of safeguarding lives and property against the improper application of electrical energy.

It pointed out that he must be a safety and technical expert for the architect, the builder, the contractor and the electrician, on all types of electrical installations; that he must be a consultant, a teacher, a coordinator, and in many cases a law enforcement officer. His "beat" was defined as the full sweep of electrical and electronic usage.

The manufacturers also cited the inspector's assistance in development of the National Electrical Code, which is under almost constant revision by the National Fire Protection Association to provide adequately for safety in electrical installation. In this his major contribution was described as pointing up the need for revisions, based on his experience in the field.

R. P. Wagner Appointed Chairman BL/BS Bureau

Ralph P. Wagner, Commercial Manager of the New York Power and Light Corporation, Albany, N. Y., has been appointed Chairman of the Better Light Better Sight Bureau, and will serve in this post for the next two years, it has just been announced by the Bureau.

As Chairman, Mr. Wagner succeeds Harry Restofski, Sales Promotion Manager of the West Penn Power Company, Pittsburgh, Pa., who recently assumed the duties of Commercial Division Chairman of the Edison Electric Institute.

Mr. Wagner will supervise all activities of the Bureau, which is now planning to supplement the educational materials it supplies as part of the industry-wide Planned Lighting Program, and to expand its present program of supplying information on light and sight to teachers in school grades.

Now – YOU CAN CONVERT YOUR PIPE BENDER TO POWER OPERATION

Enjoy These Benefits –
Less Fatigue
Work More Bends Per Hour
Savings in Time
Extra Versatility

NEW P-182
ELECTRICALLY-DRIVEN
HYDRAULIC PUMP

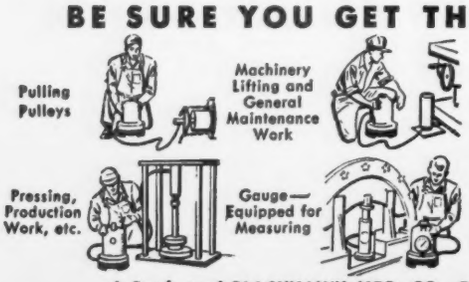
Here's Why It's a "Profit Package" for You

Economy — P-182 pays for itself on labor-saving alone. One electrical contractor estimated a saving of $63 in FOUR HOURS . . . through labor savings in making offsets on 60 pieces of 1½" pipe.

Speed — This handy pump slashes pipe bending time. Full ram travel can be obtained in ⅓ the time it takes with hand operation. And P-182 never tires — it works at top speed all day — turns out more than 3 times as much work as a hand-operated pump.

Versatility — P-182 is a complete package containing pump, valves, and controls. Conversion is simple — disconnect your hand-operated Porto-Power pump, connect P-182 and go to work. It takes the place of one or many hand pumps, handling 2 to 25 rams at one time. And P-182 is adaptable to any hydraulic system.

BE SURE YOU GET THIS EXTRA UTILITY



Blackhawk Porto-Power Pipe Benders do MORE than bend pipe. The hydraulic ram is detachable for use with P-182 and Porto-Power attachments on many other production and maintenance jobs such as machinery lifting, pulling pulleys, etc.

A Product of BLACKHAWK MFG. CO., Dept. P2088, Milwaukee 1, Wisconsin

BLACKHAWK

Victor H. Tousley Dies

Victor H. Tousley, Secretary-Treasurer of the International Association of Electrical Inspectors and Electrical Field Engineer of the National Fire Protection Association died in the Evanston, Illinois Hospital on July 12.

Born in Oshkosh, Wisconsin on June 25, 1875, Mr. Tousley graduated from Armour Institute of Technology in 1897 and served as an Electrical Inspector for the City of Chicago from 1898 to 1912. From 1912 to 1928 he served as Chief Electrical Inspector for the City of Chicago. In 1928 he was prevailed upon to accept the position of Secretary-Treasurer of the International Association of Electrical Inspectors and the Electrical Field Engineer of the National Fire Protection

VICTOR H. TOUSLEY

Association. Although the International Association of Electrical Inspectors had been organized for sometime prior to 1928 the activities of its various chapters throughout the country had never been co-ordinated. Through the efforts of Mr. Tousley this organization has grown to the point where its members come from all parts of the United States as well as Canada.

For 15 years he had been Secretary of the Electrical Committee of the National Fire Protection Association, and in this capacity assisted in the compilation amendment, revision and publishing of the "National Electrical Code," the most widely adopted and observed safety code in the United States. In addition he was co-author of eleven books on electrical work.

He is survived by Mrs. LaVina M. Tousley and three children by a former marriage: Mrs. Bernice Taylor, Wilbur H. Tousley, and V. H. Tousley, Jr.

Dates Ahead

International Association of Electrical Inspectors — Western Section, Denver, Colo., September 13-15; Northwestern Section, Salt Lake City, Utah, September 20-22; Southwestern Section, Oakland, Calif., September 27-29; Eastern

RELIABLE REMOTE CONTROL AT LOW COST...WITH

AUSTIN REMOTROL

REMOTE CONTROL SWITCH FOR YARDLIGHTS, MACHINES, PUMPS, MOTORS, ETC.

SAVES WIRE AND WIRING COSTS—ELIMINATES THE NEED FOR COSTLY 3-WAY AND 4-WAY SWITCHES—ALLOWS THE USE OF *ANY DESIRED NUMBER* OF MOMENTARY CONTACT SWITCHES.

$13.50 EACH INCLUDING TWO DESPARD MOMENTARY CONTACT SWITCHES

TERMS: 2% CASH 10 DAYS, NET 30 DAYS; F.O.B. NORTHBROOK, ILLINOIS. FREIGHT ALLOWED ON 100 LB. SHIPMENTS.

RUGGEDLY BUILT FOR LONG YEARS OF TROUBLE-FREE SERVICE

Remotrol is a thoroughly reliable remote control switch designed for indoor or outdoor operation of lighting circuits, small motor circuits, etc., where economy and convenience of operation are demanded. Built to the highest engineering standards, the unit is mounted on a bakelite panel and is equipped with large terminals having 10/32 binder head screws, and housed in a heavy cast aluminum weather-proof case. The case is designed with two heavy, slotted external lugs for easy mounting, and a drain hole, screened for protection, is provided for drainage of excessive condensation. Four ½" tapped holes, two open and two plugged are furnished for flexibility of installation. In actual tests Remotrol has operated successfully at temperatures as low as 60 F. below zero. To safeguard against overload the unit carries a replaceable 15 amp. Fustat protected by a spring-hinged cover.

CIRCUIT

The circuit carries 15 amps. of current at 115 volts, 60 cycles, AC and is designed to accommodate any number of momentary contact switches connected in parallel, using only two wires. In some applications (operation of farm yard lights, well pumps, etc.) one side is connected to switch and the other side to ground.

AUSTIN CAT. No.	AMPS.	VOLTS	CYCLES AND CURRENT	DIMENSIONS			APPROX. WT. LBS. EA.
				HEIGHT	WIDTH	DEPTH	
RCS-1	15	115	60 c., AC	8½"	6"	4"	4

HOW REMOTROL OPERATES:

The Remotrol unit consists of a solenoid plunger-type ratchet switch which is energized by operating a momentary contact switch. This action indexes the switch mechanism to complete the circuit. Circuit remains on, even though solenoid is not energized, until one of the momentary contact switches is again operated. Having become energized once more, solenoid moves the ratchet and breaks the circuit. The powerful solenoid, phosphor-bronze blades and silver-faced contacts give the Remotrol circuit a quick, positive make-break action.

WIRING INSTRUCTIONS FURNISHED WITH EACH UNIT

The M. B. Austin Company
NORTHBROOK, ILLINOIS

WE SELL EXCLUSIVELY THROUGH WHOLESALERS

Immediate Delivery
FROM STOCK

"PM" TYPE CONTROL TRANSFORMERS

Used on magnetic starters, breakers, cabinets, etc., for outside mounting where lower than line voltage is desired. Equipped with nipple and locknut for knockout mounting. Made in 50-60 cy. — 460/230 volts primary, 115 volts secondary. Capacities up to 250 V. A. inclusive.

DONGAN ELECTRIC MFG. CO.
2980 Franklin **Detroit 7, Mich.**

The Dongan Line
Since Nineteen-Nine

DONGAN TRANSFORMERS

Section, October 11-13; Southern Section, Heidelberg Hotel, Jackson, Miss., October 18-20.

Illuminating Engineering Society — National Technical Conference, Boston, Mass., September 20-24.

Electrical Contractors Society of Washington States — Annual convention, Everett, Wash., September 25-26.

International Municipal Signal Association—53rd Annual meeting, Hotel Statler, Buffalo, N. Y., October 4-7.

Porcelain Enamel Institute — Annual forum, University of Illinois, Urbana, Ill., October 13-15.

National Association of Housing Officials—Third annual exhibit of building and maintenance products, Olympic Hotel, Seattle, Wash., October 13-16.

National Electronics Conference—Edgewater Beach Hotel, Chicago, Ill., November 4-6.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., November 8-13.

Electrical & Gas Association of New York, Inc.—Luncheon meeting, Grand Ballroom, Hotel Astor, New York, N. Y., November 17.

National Electrical Contractors Association — 47th Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.

Electrical & Gas Association of New York, Inc.—Luncheon meeting, Grand Ballroom, Hotel Astor, New York, N. Y., December 22.

Independent Electrical Contractors Association, Inc.—43rd Annual dinner, Hotel Astor, New York, N. Y., January 15, 1949.

American Institute of Electrical Engineers—Winter general meeting, Pennsylvania Hotel, New York, N. Y., January 31-February 4, 1949.

National Electrical Manufacturers Association—Winter convention, Edgewater Beach Hotel, Chicago, Ill., March 13-18, 1949.

Third International Lighting Exposition and Conference — Hotel Stevens, Chicago, Ill., Week of March 28, 1949.

Manufacturers News

GENERAL ELECTRIC CHANGES

R. I. Parker of Chicago has been elected a commercial vice president by the board of directors of the General Electric Company. Mr. Parker succeeds W. O. Batchelder, who is retiring after 43 years' service.

T. B. Ellis has been appointed central district manager of the G-E apparatus department. Mr. Ellis succeeds R. I. Parker, of Chicago.

Addition of five new sales districts to the sales setup of G-E's Lamp Department was announced by M. L. Sloan, vice president and general manager of the Lamp Department at its

R. I. PARKER

WHICH G-E INSULATING VARNISH FOR YOUR JOB?

WHY G-E INSULATING VARNISH 1673 WAS SELECTED FOR THIS OUTDOOR SWITCHGEAR

Outdoor switchgear must weather harsh exposure to sun, storm, and dirt. So General Electric specialists recommended G-E Insulating Varnish 1673 for this really rugged service.

Clear-baking G-E Varnish 1673 has excellent penetration and aging qualities. It dries hard and resists almost everything—oil, heat, moisture, acids, alkalis, and arcs. And it provides amazing flexibility during assembly and in service.

Your insulating problem gets prompt, personal attention at General Electric. Depend on G-E experts to prescribe the proper varnish to do your job best. And count on G-E quality control methods to keep every shipment uniform.

Get more information from your local General Electric Merchandise Distributor. Or write: Resin and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

Here Are a Few of the Many G-E Varnishes Designed for Specific Types of Applications

	FOR REPAIR WORK	FOR MARINE EQUIPMENT	FOR TRANSPORTATION EQUIPMENT	FOR INDUSTRIAL MOTORS
	G-E 9574	G-E 9435	G-E 1686	G-E 1678
BOND	EXCELLENT	GOOD	GOOD	EXCELLENT
DIELECTRIC STRENGTH	GOOD	GOOD	GOOD	EXCELLENT
RESISTANCE TO MOISTURE	EXCELLENT	GOOD	GOOD	EXCELLENT
RESISTANCE TO ALKALI	EXCELLENT	GOOD	FAIR	EXCELLENT
RESISTANCE TO ACIDS	EXCELLENT	GOOD	GOOD	EXCELLENT
RESISTANCE TO SALT WATER	EXCELLENT	EXCELLENT	GOOD	EXCELLENT
PENETRATION	GOOD	GOOD	EXCELLENT	GOOD
TOUGHNESS	EXCELLENT	FAIR	GOOD	EXCELLENT
HIGH TEMPERATURE AGING	EXCELLENT	GOOD	EXCELLENT	GOOD
FLEXIBILITY	EXCELLENT	GOOD	GOOD	FAIR

Order . . .

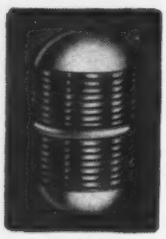
GENERAL ELECTRIC

CD48-82

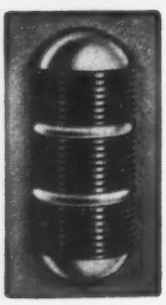
Electrical equipment is no better than its insulation

NEW LIGHTS by Cannon Electric

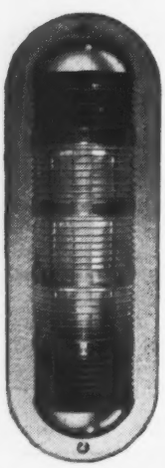
DNP-1



DNP-2



DNP-3



DPF-9

UTILITY PILOT LIGHTS

...ARE ALL-PURPOSE COLORED LIGHTS FOR SIGNALING, WARNING, DECORATION AND MODERATE ILLUMINATION, ETC.

...AVAILABLE IN 5 COLORS: CRYSTAL, RED, GREEN, BLUE AND AMBER, AND COMBINATIONS.

...TWO VOLTAGES: 12V, 15CP or 115V, 6W.

A SECOND cousin to the now well known *"Pathfinder Light,"* the Utility Pilot Lights utilize the same 180° unbreakable plastic (polystyrene) prism lens as used in the Pathfinder.

The DNP Light was first designed for the signal lights for Bullock's-Pasadena—one of the most modern, striking, up-to-date department stores in the country.

MOUNTING

DNP Lights are mounted on plaskon plates in antique ivory, or silver, bronze, copper or gold hammertone finish. Types DNP-1 and DNP-2 mount on two-gang plaster rings, DNP-3 on a four-gang plaster ring and must be mounted vertically.

SNAP-ON CONSTRUCTION

Unique for simple and easy lamp change or replacement is the Snap-on construction, requiring no tools.

Individual barriers are provided between color lens, although these may be omitted, if desired. Type DPF-9 uses a 9" 6W fluorescent lamp, without barriers.

Write for Bulletin No. UPL-1 for a color reproduction and additional data, and QL-1 for prices.

BROADCAST STATION LIGHT

This indicator Light Type Q-12 is equipped with 2 standard Cannon Electric Dome Lights mounted on a plate having an illuminated panel upon which may be lettered "ON THE AIR," "DO NOT ENTER," etc. Used inside auditoriums, control rooms, etc. Lights flash in whatever timing your present equipment provides. Write for Bulletin No. Q-1. Address Dept. No. H-231.

CANNON ELECTRIC Development Company

SINCE 1915

3209 HUMBOLDT ST., LOS ANGELES 31, CALIF.

IN CANADA & BRITISH EMPIRE:
CANNON ELECTRIC COMPANY, LTD.
TORONTO 13, ONTARIO

WORLD EXPORT (excepting British Empire):
FRAZAR & HANSEN, 301 CLAY STREET
SAN FRANCISCO 11, CALIFORNIA

Nela Park headquarters in Cleveland.

The new sales district, headquarters cities, and persons appointed to head each district are as follows:

Chicago Sales district, Chicago, with T. D. Scarff as manager and D. J. Bowden, assistant manager; a new Midland sales district, Chicago, with D. O. Dice, manager; Iowa-Illinois sales district, Davenport, with F. C. Horton, manager; Wisconsin sales district, Milwaukee, with W. B. Gustafson, manager; and Indiana sales district, Indianapolis, with J. M. Lime, manager.

A. H. Meyer, who for more than 30 years served as manager of the former Midland sales district of the Lamp Department, will continue in an advisory capacity to the managers of the new districts.

George P. Lehmann has been appointed to the personal staff of Dr. Zay Jeffries, vice president. Robert L. Gibson has been named to succeed Mr. Lehmann as manager of the Company's Plastics Division.

Appointment of Raymond G. Schiele as buyer for the G-E's resin and insulation materials division has been announced.

Erwin H. Danielson has been appointed manager of the Millerton Works succeeding William A. Stott, who has retired after 35 years with the company.

APPLETON ELECTRIC ADDITIONS TO SALES STAFF

Appleton Electric Company of Chicago, Ill., have added three new men to their sales organization. John O. Bell, Jr. will make his headquarters at 4210 Emory St., Houston, Texas, and will cover the surrounding territory.

W. J. Broughton, Jr., will make his headquarters with Z. B. Greer at 429 Brown-Marx Building, Birmingham, Ala. and will cover territory consisting of Alabama, Florida, Tennessee, Mississippi and Louisiana.

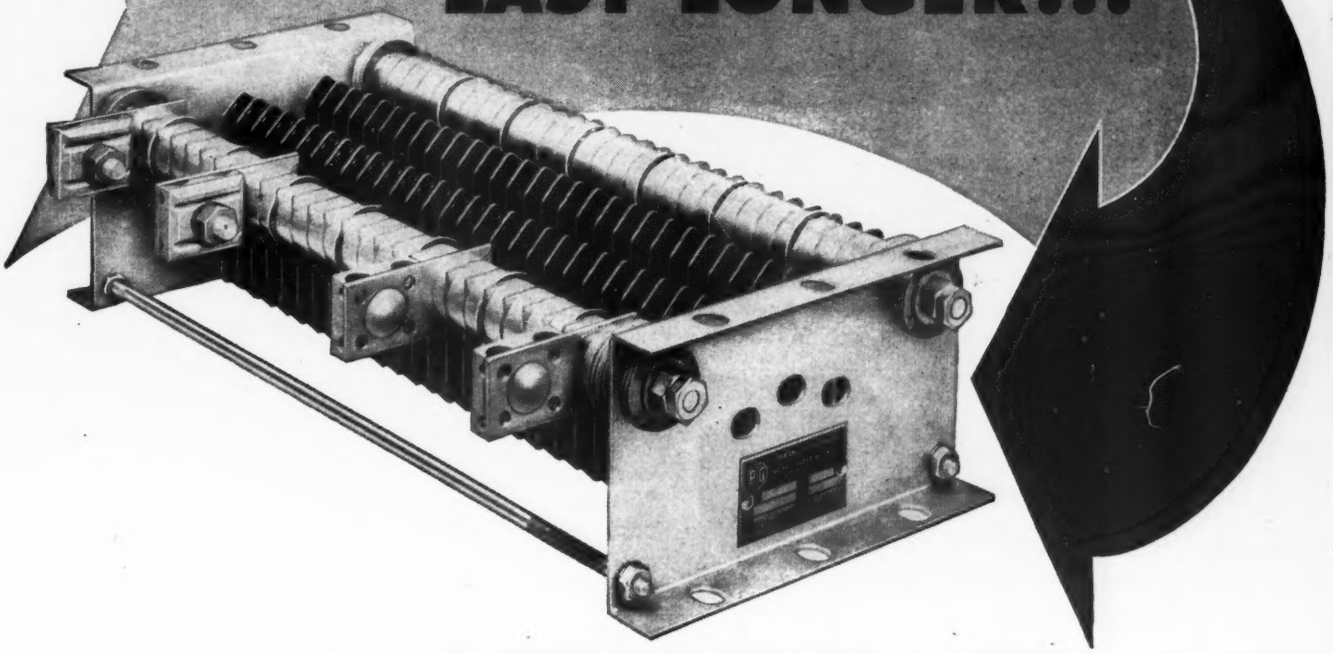
Ralph A. Olson will make his headquarters with W. E. Huskins at 305 Fifth St., South, Minneapolis, Minn., and will cover part of Wisconsin, Minnesota, Iowa, also North and South Dakota.

T. C. KELLEY JOINS ELECTRO DYNAMIC

T. C. Kelley recently became general sales manager of the Electro Dynamic Division of the Electric Boat Company, Bayonne, N. J.

Mr. Kelley was previously the sales manager of the Imperial Electric Company, Akron. Before going to Imperial, he was sales manager of the motor division of the Westinghouse Electric Corporation, which he joined in 1919 after attending Notre Dame University and serving in World War I.

P-G *Steel Grid Resistors* LAST LONGER...



. . . GIVE BETTER PERFORMANCE WITH LESS MAINTENANCE!

Constructed from Steel and Mica (durable and non-breakable materials), P-G Steel Grid Resistors are truly built to last longer. Designed to efficiently use the space available, the utmost in long and trouble-free service can be expected. Try P-G Steel Grid Resistors next time on your toughest job . . . they are rugged . . . they are dependable.

For further information—Write for BULLETIN No. 500C

P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

DID YOU KNOW
that you can get
Conduit Fittings
like this?

ALUMINUM ALLOY—2/3 less weight
With no sacrifice of strength, Kondu fittings make a big cut in the weight of conduit lines or portable equipment.

Practically CORROSION PROOF
Many times more resistant to corrosion than other materials previously used for conduit fittings.

Your choice of THREADED or THREADLESS
Threaded Kondu fittings have covers and other accessories interchangeable with the Threadless line. USE THE RIGHT FITTING every time—there's a Kondu that's exactly suited.

KONDU CORPORATION, Erie, Penna.

KONDU
The Threadless Fitting Line of Unequalled Variety

**KONDU
MFG. CO. LTD.,
Preston,
Ontario**

Bend Conduit Faster
up to 90 degees
in one operation
Tal Bender

Here's How

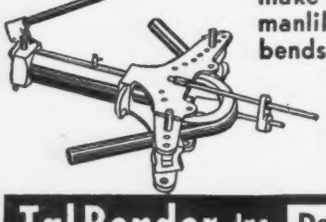
Conduit can be bent

40°
to any desired angle

60°
without moving pipe

90°
in one operation

Installation work goes faster, easier, and at a lower cost when you have a Tal's Prestal Bender on the job. This efficient, light, portable machine handles all pipe and conduit up to 3". Makes perfect bends, up to 90°, cold, in one single operation. No need to waste labor by replacing the pipe three to six times to make a bend. Does a good workmanlike job — smooth, uniform bends without kinks or wrinkles. Simple and easy to operate. Thousands are in successful use everywhere. Write for data bulletin.



Bus Bar Bending Attachment — for 3" bender. Bends up to 4" bus bar.

Tal Bender, Inc. Dept. 21 Milwaukee 2, Wis.

BULLDOG PROMOTES A. A. TOGESEN

BullDog Electric Products Co., Detroit, Mich., has announced the appointment of A. A. Togesen as sales manager.

Mr. Togesen joined the BullDog organization in 1937 as special field engineer, being subsequently appointed

A. A. TOGESEN

assistant sales manager. His entire business career has been spent in the electrical industry and he has a very wide acquaintance among electrical wholesalers, electrical contractors, and industrial engineers and architects.

MORTON-GREGORY APPOINTMENTS

Election of Leonard C. Barr, Maurice A. Enright, and William J. Kane as vice president of Morton-Gregory Corporation, has been announced by Henry J. Morton of Detroit, president.

Mr. Barr, general sales manager of the Nelson Stud Welding Division, Lorain, Ohio, and Mr. Enright, general works manager of the Nelson plant there, were added to the board of directors of the corporation. Mr. Kane is sales manager of consumer products for Morton-Gregory, with offices in Toledo, and is one of nine original directors who were re-elected.

Paul Donham has resigned his post as associate professor of management at the University of Toledo, to accept appointment as manager of commercial development for the Morton-Gregory Corporation.

ROCKBESTOS PERSONNEL CHANGES

The following personnel changes were made in Rockbestos Products Corporation district sales offices:

H. B. Hammond was relieved of his duties as district manager of the New York office to devote himself exclusively to the servicing of all departments of the Federal Government in Washington, D. C., and all private shipyards on the East Coast.

J. T. Williams, former Cleveland office manager, was advanced to the New York office as district manager.

D. S. Lee, former district manager of the Buffalo office which has been discontinued, was transferred to the Cleveland office as district manager and the Buffalo district was incorporated in the Cleveland office territory.

S. A. Sargent, former district representative of the New England territory, was transferred to the Chicago district office.

R. G. Newton, former sales promotion manager of the New Haven office, was appointed district representative of the New England territory with headquarters in New Haven.

WESTINGHOUSE APPOINTMENTS

Announcement has been made of the appointment of Russell E. Ebersole as general manager of lamp sales for the Westinghouse Electric Corporation, Bloomfield, N. J.

Mr. Ebersole succeeds William J. Massey, who retired after 50 years

R. E. EBERSOLE

with the company's lamp division.

Joining Westinghouse in 1922 as a lamp salesman touring New York's Hudson Valley communities, Mr. Ebersole advanced to manager of metropolitan New York sales; assistant manager of the Northwestern district; and manager of the Northwestern district, with headquarters in Chicago. Two years later, he moved to Bloomfield to take charge of all district offices.

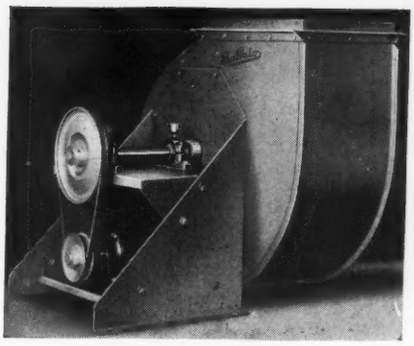
Harold G. Cheney has been named assistant manager of Westinghouse lamp sales.

POTTER & BRUMFIELD NEWS

Ralph T. Brengle, president of the National Association of Relay Manufacturers, has announced that he will devote his full time to Potter & Brumfield, Chicago, Ill.

Mr. Brengle is a stockholder and officer of Potter & Brumfield, and for several years has handled their national sales and advertising. He has discon-

AIR EQUIPMENT TO HELP YOUR BUSINESS

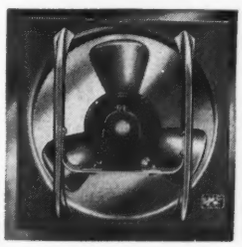


BUFFALO BELTED VENT SET

Where you want quiet ventilation for theatres, stores, shops—here's a high-efficiency heavy-duty centrifugal fan with *flexibility!* Permits capacity changes *after installation.* Easily installed indoors or out. *Write for Bulletin 3499.*

VALUES IN VENTILATION
that carry a real profit!

The "Buffalo" Fans shown here are some of our best sellers in the ventilation line! YOU'LL like them because they're easy to install and service—and because they satisfy customers. YOUR CUSTOMERS will like them because they're quiet and trouble-free, and move more air for the money. DON'T MISS THESE PROFITS! *Write now for all the facts.*



BUFFALO BREEZO FAN

"Spot" these husky, efficient fans in particular areas where fresh air is needed. Square panel means simple installation in outside walls (pressed knockouts in frame allow for bolting, if desired). Six sizes, 8" to 24". Quality, standard motors. *Write for Bulletin 3222-F.*

BUFFALO FORGE COMPANY

520 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

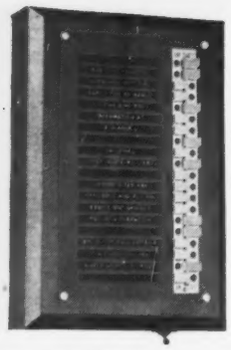
Branch offices in all principal cities

FANS by "Buffalo"

EQUIPMENT FOR

★ VENTILATING
★ HEATING
★ COMFORT COOLING
★ PROCESS COOLING
★ AIR TEMPERING
★ AIR WASHING
★ EXHAUSTING
★ BLOWING
★ FORCED DRAFT
★ INDUCED DRAFT
★ PRESSURE BLOWING
★ CLEANING
★ DRYING

CUTTING COSTS IN EVERY BRANCH OF INDUSTRY

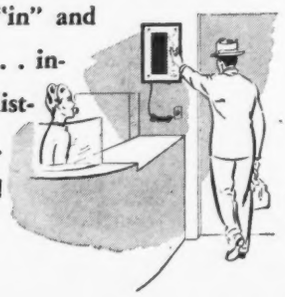


How to avoid "manhunts"

Know who's in with MONOLITE REGISTER

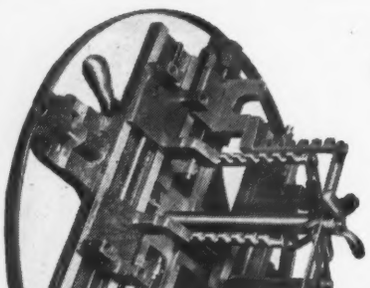
Time is lost and tempers rise when, after a long search, you find the person you want has been out all the time. Couch Monolite Registers provide a simple, workable solution.

By simply flipping a shutter, a red or green signal light beside each name listed show who's "in" and who's "out" . . . plug in connection . . . installed easily. Available in models listing names in multiples of 20 up to 80. Used in hospitals, clinics, professional buildings, and offices. Full information on request.



S. H. COUCH COMPANY, INC.
Dept. 808 NORTH QUINCY 71, MASS.

PRIVATE TELEPHONES for HOME and OFFICE . . . HOSPITAL SIGNALING SYSTEMS . . . APARTMENT HOUSE TELEPHONES and MAILBOXES . . . FIRE ALARM SYSTEMS for INDUSTRIAL PLANTS and PUBLIC BUILDINGS.



COIL WINDING TAKES A HEAD!

For efficient, accurate coil production, the GC HEAD pictured above is without parallel in the electrical industry. Its construction embodies a cam collapse mechanism for all winding fingers which allows quick removal of coil groups and instantaneous repositioning for further winding.

Winding fingers are set to coil dimensions by screw adjustment and a complete setup can be made *in less than two minutes.*

Attachments are available for loop winding and single phase winding. Swivel End Finger attachment forms knuckles in the nose of the coils which removes strains, makes winding easier and reduces possibility of short circuits.

Can you be satisfied with less than the best?

● Write for descriptive literature on the GC HEAD and other winding equipment of our manufacture.

POTTER & RAYFIELD, INC.
ENGINEERING CRAFTSMANSHIP

P. O. BOX 1042C ATLANTA, GA.

tinued his operations as Ralph T. Brengle Sales Co., manufacturers representatives, and has turned this phase of his business over to the newly formed Lund-Hansen Co., who will continue to represent Potter & Brumfield and other lines formerly handled by Mr. Brengle in the Chicago area.

Benson Reark has been appointed factory superintendent of the Princeton, Ind. plant of Potter & Brumfield.

L. H. CRAFTS JOINS UNIVERSAL

L. H. Crafts has been named vice president and general sales manager of the Universal Motor Company, Oshkosh, Wis.

For a number of years, Mr. Crafts was general sales manager of the automotive, industrial and marine division of Lycoming Manufacturing Company

L. H. CRAFTS

and later eastern sales manager of the Buda Company. He left the Buda Company to take charge of the Washington office of the Sterling Engine Co. as assistant vice president and during the war served as a member of the Internal Combustion Engine Section of the War Production Board. Following the war he has been acting as sales manager of the Curtis Marine Company, Inc.

WARE CHANGES

Ware Brothers of Chicago, has announced a change in their corporate name to Ware Fuse Corporation. Operations will continue under the same management as heretofore.

The following have been appointed representatives: Kenneth Anderson Co., Los Angeles; Hodges & Glomb, San Francisco; Industrial Products Co., Pittsburgh; M. B. Urquhart, Denver; Electrical & Steel Sales Co., Inc., Milwaukee; E. B. Rouzer, Minneapolis; Henri Duizend, New Orleans; R. J. Milford & Son, New York; Thos. J. Fleisher, Atlanta; C. C. Pierce Co., Boston; A. Weingarten, Philadelphia; Anchor Sales Co., St. Louis; Electronic Specialty Representatives, Portland, Oregon; Howard H. Loving, Chicago.

DAY-BRITE APPOINTS GENERAL SALES MANAGER

Day-Brite Lighting, Inc., has announced the appointment of James F. Whitehead, Jr., as general sales manager.

Mr. Whitehead was educated at Georgia Tech., and upon leaving school,

J. F. WHITEHEAD, JR.

was employed by the Georgia Power Co. in the operating department. In December, 1944, he became associated with Day-Brite Lighting, as their factory representative covering Georgia, Alabama and eastern Tennessee.

WESCO APPOINTMENTS

Announcement has been made of the appointment of T. F. Barney as New England District apparatus and supplies manager of Westinghouse Electric Supply Company at Boston, Mass. He succeeds R. N. Chapman, who has been transferred to WESCO headquarters as training supervisor.

William Bell, former apparatus and supplies salesman, WESCO, New York, has been named branch manager of the Hempstead, L. I. house. Mr. Stapleton, former manager of the branch will continue there on a special assignment.

Midwest district headquarters at St. Louis, Mo., has assigned Ward Caldwell to the post of district farm sales supervisor.

NEW LIGHTING FIXTURE FIRM ORGANIZED

J. H. Millstein, president of the J. H. Millstein Company, Jeannette, Pa., has announced the organization of a new, wholly owned subsidiary, the Lightcraft Corporation. The new firm manufactures a complete line of lighting fixtures, designed specifically for kitchens, game rooms, dinettes and bedrooms, as well as for commercial establishments.

Harold L. Pomerantz, formerly with Glasolier Company, has been named general sales manager of the new organization.

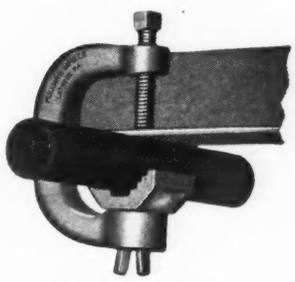
FULLMAN Latrobe PRODUCTS

FLOOR BOXES — WIRING SPECIALTIES

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE OB SUPREMACY LATROBE, PA.

QUICKLY INSTALLED AND EFFICIENT IN OPERATION

There is nothing complex or intricate about "Latrobe" Floor Boxes and Wiring Specialties. Their design and mechanism is kept simple and sure. That is why "Latrobe" Products are so quick to install and so trouble-free in operation.



No. 470 "Latrobe" Pipe or Conduit Hanger

Made of highest grade malleable iron, this sturdy hanger is economical and a sure performer. Hangs pipe or conduit ½", ¾" and 1" to steel beams ⅜" thick.

No. 280 Nozzle with No. 200 Cover Plate

10 Amp. 250 Volt Receptacle in Brass Housing, mounted on ½" brass pipe extension 3" long—longer extension if desired.

No. 150 Box— No. 207 Nozzle

An adjustable, watertight box for installation in concrete or wood-finished concrete floors. 4¼" Cover Plate No. 242 and large Adjusting Ring No. 215.

No. 110 "Latrobe" Watertight Box

A non-adjustable, watertight Floor Box which is extremely simple and compact in design, making for speedy installation and trouble-free service. 20B Receptacle. Cover Plate 3½" diam.

"Bull Dog" BX Cable Staples

Favorites in every section of the United States, these high quality dependable staples are available in cartons, kegs or barrels.

Sold Only Through Wholesalers

"Bull Dog" Insulator Support

"Bull Dog" Supports can be trusted for fastening porcelain or glass insulators to exposed steel framework. Four sizes, from 1" to 2½".

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

National
engineers KNOW insulation

National offers more than insulation and service. *National knows how.* Through actual experience, the National Insulation Engineer knows how his material is manufactured—what it is designed to do—how it performs under the most difficult applications and how to use the insulation most efficiently in your plant.

National Insulation Engineers can offer production hints which often save time and money and make for better employee efficiency.

Use National Service. A complete source of electrical insulation materials. Delivery from large stocks.

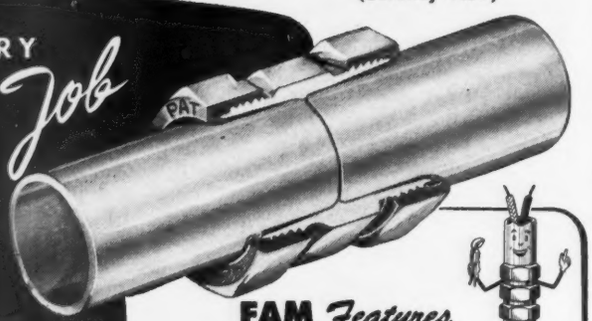
You are protected by National's experience and National's extremely particular Inspection Department.

Send for a National Insulation Engineer—*today.*

NATIONAL ELECTRIC COIL COMPANY
COLUMBUS 16, OHIO, U. S. A.
ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION— REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES
TRADE MARK

FOR EVERY *Fitting Job*
SPECIFY AND USE
FAM
STEEL
EMT
THIN WALL
COUPLINGS AND CONNECTORS

FAM Coupling (Cutaway View)



FAM *Features*
1. Simple, fast installation
2. No rings to cock or lose
3. Precision machined taper fit
4. Cuts surface for positive ground
5. Raintight—UL Approved

Write for Descriptive Literature

FAM Connector

FISHER-ARMOUR MFG. CO.
757 Waveland Avenue
Chicago 13, Illinois

Announcement has been made of the change in name of the **Metropolitan Device Corporation** to **Murray Manufacturing Company,** Brooklyn, N. Y. It does not involve any change in the company's structure, its personnel, its policies or any of its activities.

•

Crocker-Wheeler Electric Manufacturing Co., Ampere, N. J., Division of Joshua Hendy Corporation, has announced the appointment of Ralph S. Drummond as manager of the Cincinnati branch office. He was formerly sales manager of the Dynamotor Corporation.

•

New quarters for the Houston sales office of **Cutler-Hammer, Inc.** have been opened at 2415 San Jacinto St., Houston, Tex. P. G. Greene will manage the office as a branch of the company's Dallas district sales office.

•

The appointment of Dr. Henry H. Hausner as a member of the staff of the Metallurgical Research and Development Laboratories of **Sylvania Electric Products Inc.** has been announced. He will specialize in powder metallurgy for application to electron tubes, lighting and special products.

•

The Langevin Manufacturing Corporation announces the sale of the Electronic Industrial Control Division to Ralph J. Hugh and Stephen J. Deitz, former sales director and application engineer of the division.

•

Lindberg Engineering Company, Chicago has announced the appointment of Ralph S. Poulsen as district sales manager for the Ohio territory. His office will be in the NBC Building, 815 Superior Ave., Cleveland, Ohio.

•

E. I. Funk of St. Louis has been appointed manager of supply specialty sales by **Graybar Electric Company, Inc.** Mr. Funk's headquarters will be at 420 Lexington Avenue, New York.

•

Theodore W. Becker, Jr., has been appointed New York district sales manager of **Ideal Industries, Inc.,** Sycamore, Ill. His office is located at 61 E. 11th Street.

•

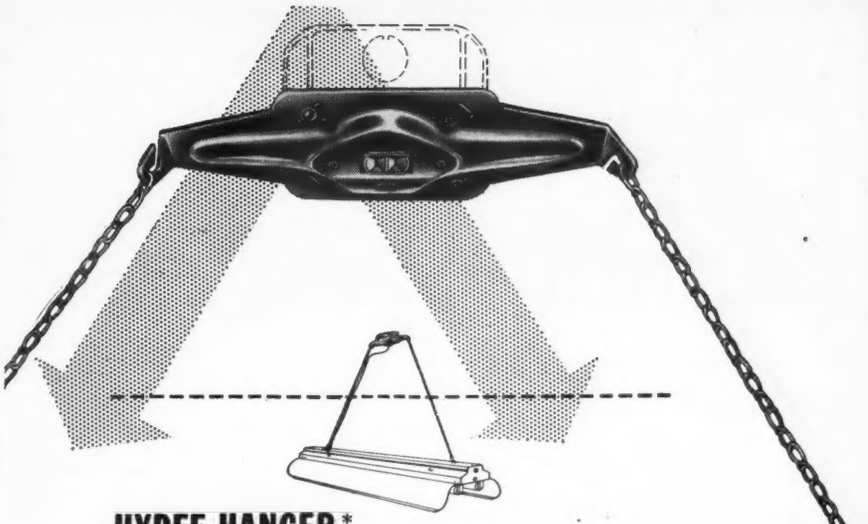
Knox Porcelain Corporation has completed its plant expansion program in Knoxville, Tenn., with the addition of 47,000 square feet of steel and concrete structure and a new oil-fired kiln.

It's a Fact!
ILSCO LUGS ARE 10% to 20% COOLER
than the heavy cast lugs you now use.

Prove it to yourself—

WRITE FOR SAMPLES and the Ilsco 54-page illustrated catalog.

ILSCO COPPER TUBE & PRODUCTS, Inc. CINCINNATI, OHIO



HYDEE HANGER*
hangs chain suspended industrial fixtures quicker, easier

A screwdriver is all you need . . . for new or "change-over" jobs. Fits standard 4" or 3¼" outlet box or plaster ring. Self-grounding . . . you can use 2-wire cord and plug. **Complete** with receptacle, two 5-foot chains, spring wire "S" hooks and cord clips.

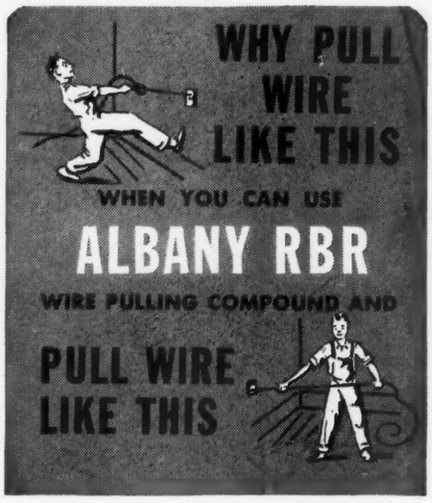
$1.65 LIST

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

011

*Patent No. D-141024 and No. 440914
Underwriters approved.

IT'S EASY TO SEE WHEN IT'S **DAY-BRITE** *Lighting*



ALBANY RBR WILL NOT EVAPORATE
Easy to apply—EASIER to pull with Albany RBR. Dynamometer tests show LOWER stresses than with ordinary compounds. On-The-Job tests show higher efficiency in wire pulling at a lower cost. Albany RBR does a BETTER job with every type of covered wire and is absolutely harmless to covering. Try it once—you'll always use it.

ORDER FROM YOUR SUPPLY HOUSE OR DIRECT FROM

ELECTRICAL PRODUCTS DIVISION
ADAM COOK'S SONS, INC.
Mfrs. of Albany Lubricating Products
LINDEN, NEW JERSEY

CUT DAYS OFF WIRING JOBS...

WITH THE KETT TALL REACH WOOD BORER

Bores Thru Wood, Steel and Masonry! Does Five Day Hand Boring Job in Less Than A Day.

• The KETT Borer solves every boring problem for electrician, plumber, etc. Eliminates ladder-climbing . . . reaches up to 10 feet above floor. Removed from extension, it's a versatile hand tool . . . boring in "hard" corners. Paying for itself on the first few jobs, the KETT Borer saves time, money, worker fatigue and accidents. Customary bits in 11/16", 12/16" and 16/16" sizes available.

See your distributor for demonstration or write for Bulletin F-8.

The **KETT** *Tool Company*
5 EAST THIRD STREET
CINCINNATI 2, OHIO

MANUFACTURERS of ELECTRICAL EQUIPMENT!

Cash in on the tremendous sales possibilities in the theatre field by advertising in the

BIG SEPTEMBER LUMINOUS DISPLAY ISSUE of the MODERN THEATRE Section of BOXOFFICE

It's designed to sell electrical equipment to 20,270 theatres. Phone, wire or write for details.

THE MODERN THEATRE

825 Van Brunt Blvd.,
Kansas City 1, Mo.
Phone: Chestnut 7777
9 Rockefeller Plaza, New York 20, N. Y.

EQUIPMENT NEWS

[FROM PAGE 103]

Air Reduction Sales Company, New York, N. Y. announces the new Wilson "Wasp Special" air cooled, engine driven **arc welding** machine. . . . The Horvath Tool and Manufacturing Co., Detroit, Mich. has developed a **masonry bit** with double exhaust flutes for drilling deep holes. . . . Standard size section steel **panelboards** that are interchangeable and replaceable, have been developed by K & H Industrial Products, Akron, Ohio.

A new electric garden **lighting unit** known as Floralite that can be plugged into any convenient outlet is being introduced by Steber Mfg. Co., Broadview, Ill. . . . The Tesco Rotary **tap switch** has been developed by the Eastern Specialty Co., Philadelphia, Pa. Each switch section is rated at 50 amperes, continuous duty, with an overload capacity of **75 amperes.**

A new line of closed tank **float switches** is being produced by the Automatic Control Co., St. Paul, Minn. . . . A new two light fluorescent **industrial fixture,** featuring aluminum wireway channel and reflectors, has been announced by the Kahn Manufacturing Company of Milwaukee, Wis. . . . A new model 450 series of Hi-Meg **multitesters** has been developed by Radio City Products, New York,

Kahn Manufacturing Company of Milwaukee, Wis. has developed the **"Hi-Spot-Lites"** for indoor spotlighting of merchandise. May be used individual, at the ends of commercial fluorescent fixture, or in between fixtures in continuous rows. . . . Cutler-Hammer, Inc., Milwaukee, Wis. has developed the new capsule-coil construction of **lifting magnet.** . . . A new line of capacitor start; induction **electric motors** for heavy duty has been announced by King-Wyse Inc., Archbold, Ohio.

Weller Mfg. Co., Easton, Pa. has announced two "longer reach" **soldering guns**—8 inch and 12 inch units. . . . A two-lamp **fluorescent unit** with matching single incandescent spotlights that can be installed individually or in continuous rows has been announced by Westinghouse Electric Corp., Pittsburgh, Pa. . . . The Fisher-Pierce Co., Inc., Boston, Mass. has developed a new Series 63300 photoelectric **control** for street lighting. Models are available for both 120 and 230 volts, 50-60 cycles.

Westinghouse Electric Corporation, Pittsburgh, Pa., has brought out a new transformer thermal load **relay.** . . . The "Rancher" fan is the newest addition to the fan line of the Lau Blower Co., Dayton, Ohio. . . . A new one half inch **electric drill** has been introduced by the Portable Electric Tools, Inc., Chicago, Ill. . . . The Crown Industrial Products Company, Chicago, Ill. has announced a new electric panel type **tachometer** for providing continuous speed measurements of rotating equipment.

HOYT
AC LINE TESTER
. . . . for a quick line on voltages!

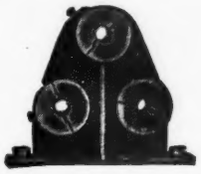
How many volts in the line? On the answer depends the efficient operation of every electrical machine or accessory. And here's how to get the answer—fast! The HOYT Model No. 568 AC Line Tester quickly and accurately indicates actual AC volts at any outlet! Test leads with special probes speed this vital check-up, while a carefully designed dial makes readings easy and precise. A red line on the 2-range scale (0/150/300 volts) indicates 110 and 220 volt readings. This precision HOYT Meter is ruggedly built to give you long, high quality service, yet it's compact enough to fit conveniently in your coat pocket! Ample insulation of the test leads makes it completely safe to use. Ideal for industrial testing and checking and for shop or bench work. Order this indispensable Tester from your Jobber today!

BURTON-ROGERS CO.
Sole Selling Agents: Hoyt Electrical Instrument Works
292 MAIN STREET, CAMBRIDGE 42, MASS.

SIMPLICITY PLUS!

New NON-INDUCTIVE CABLE RACK

for INDUSTRIAL PLANT WIRING



Type D-F 3-Conductor Cable Rack. New Non-Inductive Design. Racks available for cable sizes from 5/16 to 2⅜"

● Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked Cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction . . . installation of cables made quick and easy through the use of split bushing.

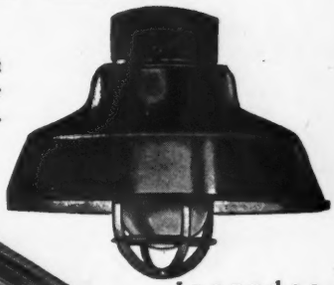
Send today for Bulletin C-S-51 which illustrates the complete line

THE M. & W. ELECTRIC MANUFACTURING CO., INC.

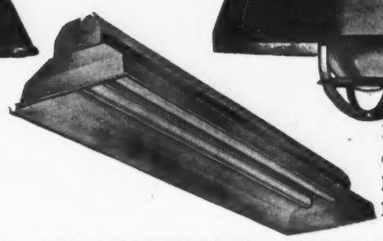
EAST PALESTINE, OHIO

MULTI

Fluorescent Lamp Fixture for shop, mill, factory



Incandescent Steel Reflector Porcelain Enamel



Incandescent Vaporproof Fixture Dust and Moistureproof

INDUSTRIAL LIGHTING EQUIPMENT

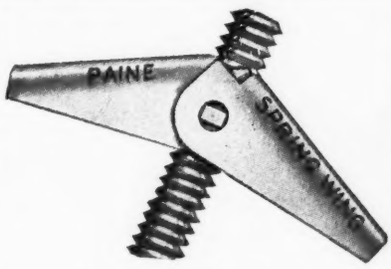
Better Lighting Makes Better Business for User and Contractor . . . . . .

For modernization needs of all kinds the MULTI line is your best bet—every unit has a specific need and will give a maximum of service life with a minimum of maintenance. Indoor or outdoor—fluorescents or incandescents—general or localized—MULTI fills the bill. Better lighting installations make for better business and the contractor gets a good share of this profitable market when he uses MULTI units.

● Send for our complete catalog.

MULTI ELECTRICAL MANUFACTURING CO.

4223 W. Lake Street . Chicago 24, Illinois



PAINE

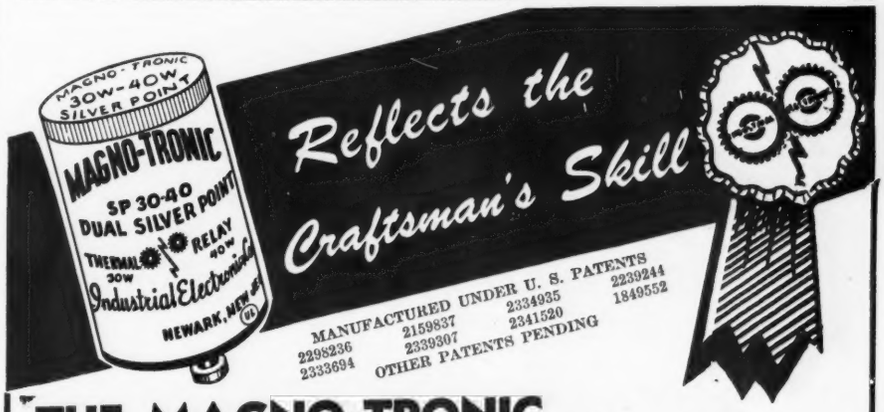
SPRING WING TOGGLE BOLT

The Paine Spring Wing Toggle Bolt—a must item for hanging anything to hollow material such as wood, gypsum, marble, lath, plaster, tile and sheet rock—it's easy to install—drill hole—slide wing end through—tighten bolt and you have a sturdy positive anchorage.

Send for the complete catalog on Paine fastening and hanging devices.

THE PAINE CO. 2961 Carroll Ave. Chicago 12, Ill.

★ PAINE ★
FASTENING and HANGING DEVICES



THE MAGNO-TRONIC FLUORESCENT STARTER

PROTECTS Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment.

SIMPLIFIES Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push.

REDUCES COSTS Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.

VERSATILE Will operate efficiently over an extended voltage range under widely varying temperatures.

GUARANTEED FOR ONE YEAR.

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BANK SIGNALS AND ALARM SYSTEMS [FROM PAGE 59]

By the annunciators in all zones; (2) By lamp signals adjacent to the calling device. A typical layout of this system is shown in Figure 4.

The guard's call is operated from the counter pushbuttons which do not operate the gong circuits, but simply indicates on all annunciators that the presence of a guard is desired at that point. The buzzer in the annunciator serves to call immediate attention to the signal. In addition to this signal a lamp is lighted near the signaling device to assist the guard in quickly locating the call. Each zone may be provided with an individual lamp annunciator, containing lamp signals operating in multiple with each cage signal lamp.

The emergency alarm system is operated from the foot-rail switches which close the alarm bell circuits and indicates on the annunciator, at the same time lighting the signal lamp nearest to the source of the call. Different colored lamps may be used in the lamp signal unit to distinguish between the guard's call and the emergency call. A control panel is used to take care of the alarm circuits and to electrically supervise the wiring, equipment etc.

A watchman's report system is very important in a banking institution to protect the premises at night, Saturdays, Sundays and holidays. A reliable system of interconnected units for recording the activities of an individual performing his duty has become by custom an indispensable feature of protection.

Various types of watchman's report systems may be used. In a small institution a compulsory tour type of system may be installed. In large buildings a report system with a telephonic feature would be preferable. In the compulsory type of system an electrical transmitting station may be used for starting and finishing the tours. Between these points intermediate non-electrical stations may be used. The watchman inserts his tour key in each station, beginning with the starting station and ending with the finishing station. Each station is called on in sequence. It is possible to include an emergency station in each tour which is only used in extreme emergencies. A record is printed or embossed on a chart or tape in the recording clock which is located at some point of supervision.

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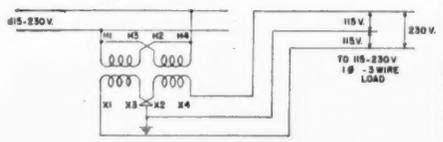

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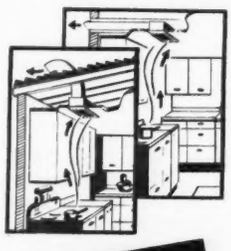

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telephonic feature is composed of stations located at all points to be covered by the watchmen. Each station is comprised of a sturdy jack and jewelled bullseye with receptacle and lamp. The system is divided into tours so that each watchman covers a certain portion of the building efficiently. A watchman's control desk is located in the guard room and contains an indication for each station, switches for each tour with their associated pilot lamps, and the recording chart. The telephone facilities for the chief guard consists of a handset telephone and a loudspeaker. Each watchman is provided with a dummy plug and a handset with cord and plug. Normally the dummy plug is inserted in each station along the tour. However, in case of emergency, the watchman may insert the plug connected to his handset into the station jack, and in doing so a light for a specific tour illuminates. The chief guard then operates his tour key corresponding to the lamp which is illuminated and may talk with the watchman. This tour also permits the chief guard to operate the bullseye lamps in the stations along a tour which will indicate to the watchman that he is to insert his plug for the handset to receive instructions from his supervisor.

An adequate fire alarm system should be installed to guarantee personal safety to the occupants. Irreparable damage may be accomplished if a fire cannot be checked in time to prevent destruction of valuable documents and other possessions which constitute the principal records and working papers. In most cases a closed-circuit electrically supervised plain code fire alarm system is found to be satisfactory. The system in general consists of the necessary number of coded stations and alarm bells with the associated control panel and a punch register for making a permanent record of any alarm.

Annunciator systems are used for many purposes. In offices they may be used to call secretaries, messengers and other employees. In most cases they are of the lamp type since they may be seen for a considerable distance and present an appearance worthy of the surroundings.

Most of the lamp annunciators are controlled from push buttons in which case relays are used to close the circuit to the lamps. In small systems the relays are often included in the same housing with the indicators. In large installations the relays are mounted in separate cabinets. However, some systems are controlled from small toggle

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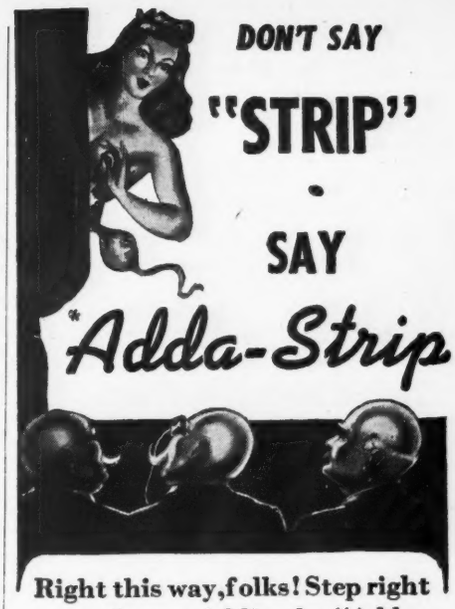
switches which must be reset at the point of call, usually by the party called. The use of toggle switches eliminates the relays.

Tellers' call systems are in most cases of the pilot light or lamp annunciator type. They operate from pushbuttons in the tellers' cages to annunciators at an attendant's desk, or they operate from pushbuttons or toggle switch blocks at attendant's desks to a bullseye or pilot lamp station at each teller's cage. These systems are used to call messengers, clerks to obtain cashiers checks, or other assistants to check special accounts etc.

A vault telephone system should be installed in every bank to permit of communication from the main vault to some outside point for calling assistance in case of emergency or accident, or should some individual become locked in. This may be a system of two or more telephones independent of any other system, or it may be a telephone connected to the regular system.

Clocks are always considered essential. Besides equipping offices with time pieces, large spaces usually require one or more large decorative type units. Very frequently clocks are also desired on the exterior of the building above the entrance and in the tower.

Coupon booth systems are furnished in different types. One of the most popular systems is the one where the doors to the booths are normally open, so that when a patron enters, the closing of the door operates a door switch and automatically illuminates an indication on the attendant's annunciator, indicating occupancy. In another system the booth doors are normally kept locked and the attendant admits the patrons and operates a locking type lighting switch, which in addition to illuminating the booth, lights a signal lamp over the door of the booth, and on the attendant's annunciator. When the patron vacates, he cannot extinguish the lamps, and therefore the attendant inspects the booth. He then extinguishes the signal lamps and leaves the booth in readiness for the next patron. In addition to either system, each booth is equipped with a pushbutton wired to another annunciator or a separate section of the annunciator indicating the door signals. This part is used for calling the attendant. Pressing the pushbutton operates a corresponding lamp in the annunciator. Resetting of such calls may be accomplished by operating an individual reset button in the trim of the annunciator. A typical layout of a booth system is shown in Fig. 5.



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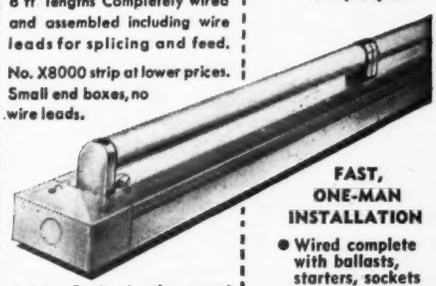

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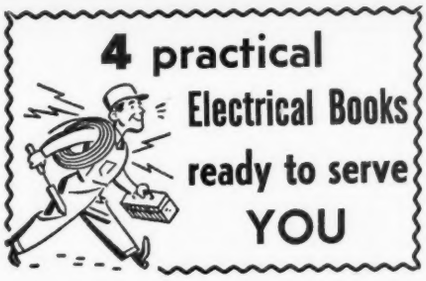

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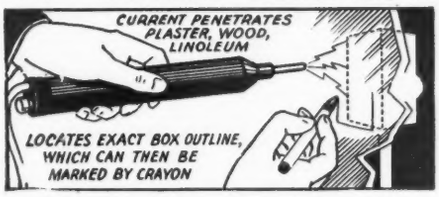

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Whether you are "roughing in" or making permanent connections, you can save time and money on any wiring job by using SCRU-ITS. They are fast and easy to use. No tools are needed.

Just strip the wires, screw on a SCRU-IT, and you have a tight, permanent joint. SCRU-ITS make a better connection electrically and are stronger than outmoded solder and tape joints. U. L. approved.

So Easy To Use

1. STRIP ENDS

2. SCREW ON A SCRU-IT

3. THAT'S ALL

4 Sizes for Solid and/or Stranded Wires

Write for SAMPLES and SPECIFICATIONS

SEND DATA SHEET NO. 1006 TO

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Street .....
City .....
Type of Business .....

SOLAR ELECTRIC CORPORATION
FACTORY AND SALES OFFICES
WARREN, PENNSYLVANIA

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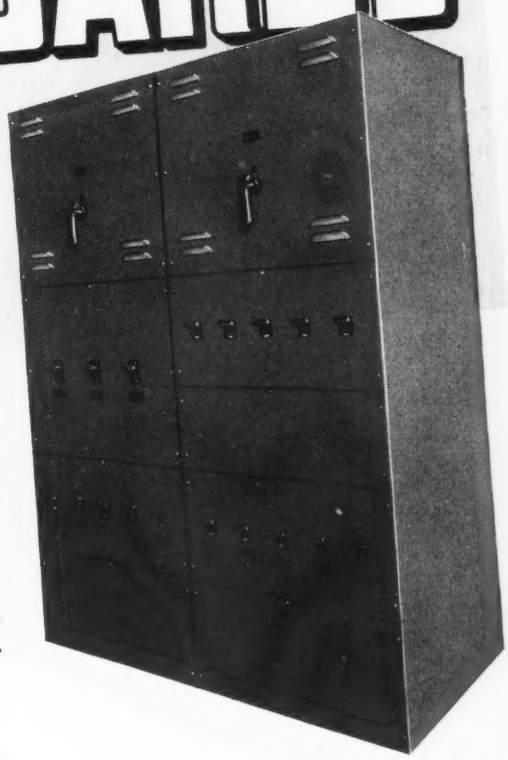
SWITCHBOARDS

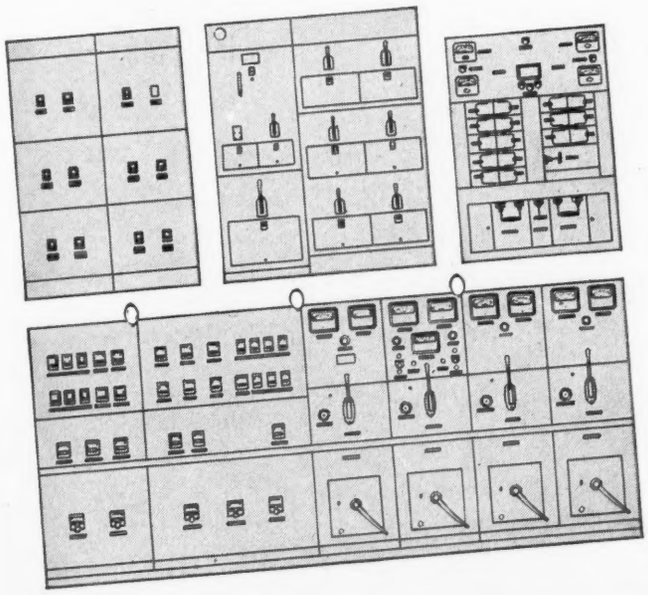
Tailor-Made
TO FIT EACH JOB



QUICK DELIVERY through enlarged production facilities and streamlined manufacturing procedures.

ENGINEERING SERVICE— layouts and quotations by qualified Field Engineers in all principal cities.

EXPERIENCE—design and manufacturing "know how" gained through long experience in electrical distribution and control equipment fields, and *specialization* in switchboards.



Switchboards are the *foundation* of all electrical distribution systems. Sound basic design and dependable equipment are essential to effective protection and consistent, long-time service.

SQUARE D manufactures a complete line of switchboards and the items of electrical distribution and control equipment used in them.

A SQUARE D installation means that you *always* will be able to change or add circuits as new requirements develop.

Call in your nearby
Square D Field Engineer

for further information on switchboards and all types of electrical distribution and control equipment.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

What's my Name?

(A 63-second quiz about typical products in our big family of wiring materials.)

1

I never make a bit of noise, yet my smooth, efficient operation results in long service life that is something to shout about. Your customers like to see me in bedrooms, theaters, offices, and many other places where silence and top performance are especially desirable. What's my name?

2

Cost-conscious contractors have found that it is often advisable to use me in place of lead-covered cable for installations in raceways in wet locations. They find that I am easy to install and can use smaller conduit. I really have two names. What are they?

3

Sometimes I wear asbestos, sometimes glass, and sometimes silicone with either glass or asbestos. My core can be round, square or rectangular. You can bend me easily, but I will not crack or rupture. A great many electric products work better and last longer than ever because they have me. Guess who.

4

I am coated inside and out. It's difficult to hurt me with even the toughest treatment. My color is white when I fight atmospheric corrosion, black when I fight chemical action. Many types of boxes and fittings have been designed to go with me perfectly. My name is so well known that it should be easy to identify.

5

I have thousands of parts, of many sizes, types and capacities. I am readily available in any quantity—all from a single source. My parent has the best-known name in electricity. Know what it is?

ANSWERS

1

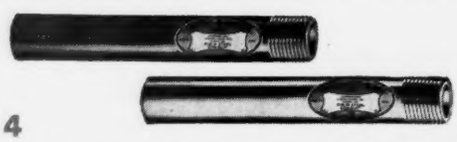
It's General Electric's silent mercury switch, the specification-grade switch that helps you make good wiring better. We'd like to remind you, too, that it is now rated 10 amperes T, at 125 volts to meet today's heavy loads.

2

My name is either G-E *RW* — for rubber-insulated moisture-resistant wire—or G-E *TW*, for thermoplastic-insulated wire of the same type. We suggest you try RW or TW for economy on your next raceway installation in any of the following: (1) underground; (2) in permanently moist locations; (3) in concrete slabs or masonry in direct contact with the earth.

3

The name is one thing upon which good electrical performance depends — *Deltabeston* magnet wire.* It's interchangeable with double-cotton insulated magnet wire, and smart contractors everywhere know that using it is one of the best ways to insure reliable motor service under all conditions.



4

If you've ever used conduit you've probably guessed that these names are *G-E White* and *G-E Black* rigid conduit. They are bywords for high quality wherever conduit is used. The rest of the General Electric line of raceways includes boxes, hangers, fittings, "flex," and EMT—all made to work to the best advantage with one another.

5

The answer should be easy—General Electric's full line of wiring materials. Whatever you need—wire, cable, raceways, wiring devices, fluorescent accessories, of every variety—your best single source of supply for dependable quality is always General Electric. We'll be glad to give you full information on any products in this full line. Just write to Section K8-818, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

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